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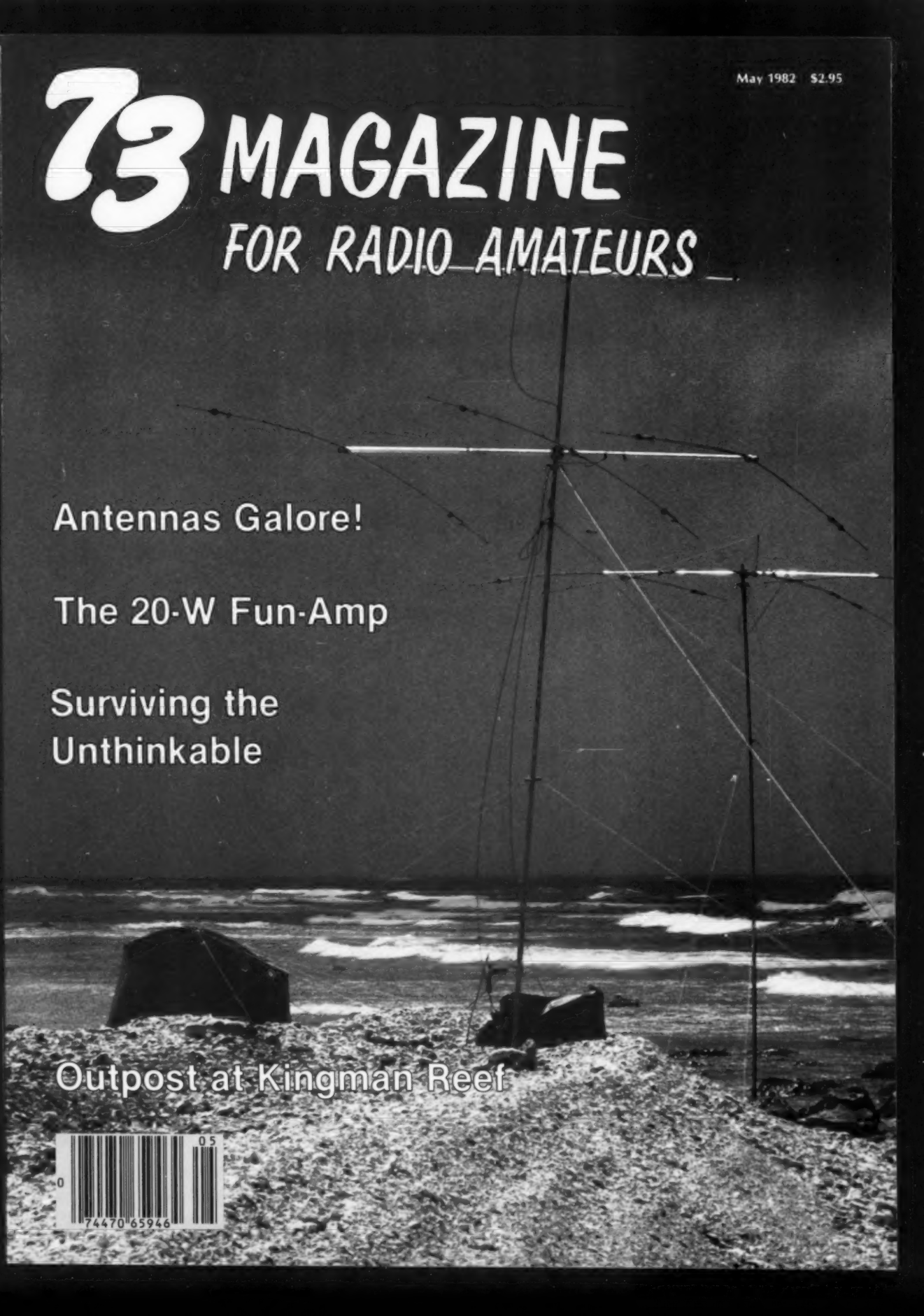

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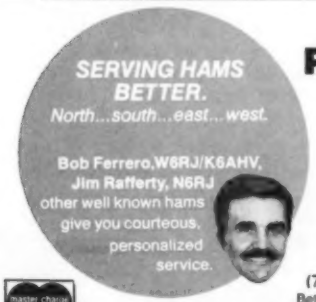

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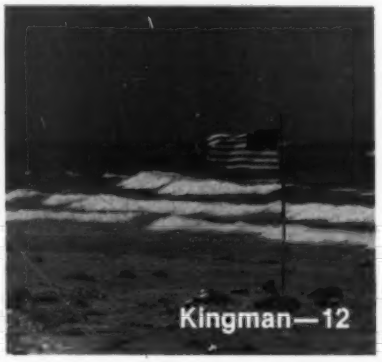

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W2NSD/1
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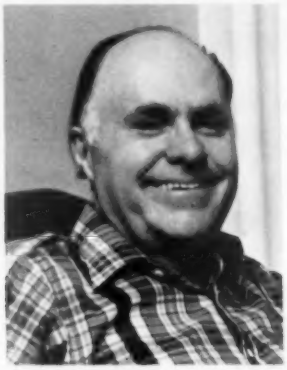

ENERGIZER. . .OR NICAD?

If you are anything like me, you keep buying these new electronic toys which are coming on the market. Since most of them require batteries to run, you probably are also buying up a storm of AA batteries. My flash units use 'em. My portable stereo recorders use 'em. My Sony Walkman uses 'em. My Sony Typecorder uses 'em.

The next question is this: What type of battery should you get? It is positively bewildering to go into my friendly radio store and see a wide assortment of batteries facing me. There are heavy-duty batteries, long-life batteries, energy cells, and so on. I'm sure that you, too, have faced this problem and wondered what to do. Unfortunately, the tendency is to sucker in and go for the most expensive battery, figuring you usually do better if you go first class. . .after all, it's only a few cents extra to go first class.

Salvation is here, so pay attention. The answer to the problem may not be what you think. The fact is that once I made a study of the situation I was amazed to find that I had been blowing a good deal of money on the wrong batteries.

The best bargains of all, probably not surprising to you, are the nicads. These are the most expensive, but if you keep 'em charged your cost per hour of use will eventually be the lowest. If you are going to buy anything except a nicad for regular use you will do best to buy the cheapest battery you can. Sure, some of the high-priced batteries will last almost twice as long. . .but they will also cost four times as much. That's no bargain.

A WORD FOR DX OPS

The ham who is living in a third-world country has a special responsibility both to amateur radio and to the country. In the long run, amateur radio will grow as a result of the development of local amateurs rather than having to depend entirely on visitors.

In many of the countries I have visited, the hams have taken this seriously but have been frustrated at almost every turn. . .particularly in Africa. When you start out with most of the population having a very low level of education together with extreme poverty, your possibilities are immediately limited to a handful of the wealthier people. In most of the countries, the kids have to be sent outside the country if they are going to get much of a high school education. . .the age when amateur radio is most likely to take hold. . .so you really can't do a lot within the country.

What is the motive for a teenager in a small African country to go to the trouble to learn about electricity, radio, and electronics so he can talk with middle- and older-aged white hams around the world? Only a tiny percentage could ever hope to own a station. . .and for what? His peers would put him down and there would rarely be enough interest for a club to get started.

Some of the kids have school available, but the conditions are not exactly encouraging. There are few, if any, books, and teachers are poorly trained and paid. The classes are crowded, so little interest or enthusiasm is developed for continuing the experience.

WARC-BAND BEACON

The 10-, 18-, and 24-MHz bands, allocated to amateur radio by the 1979 World Administrative Radio Conference (WARC), are not yet available to US amateurs for general use. However, experimental station KK2JXM, licensed to W4MB, transmits on these bands every Friday, Saturday, and Sunday. Since most newer transceivers are equipped to receive the new bands, many amateurs have the capability to monitor the KK2JXM beacon and learn about propagation at these frequencies.

KK2JXM begins its transmissions at 0000 UTC every Friday, continuing through 2400 UTC Sunday. During the last two weekends in April and the first two weekends in May, all transmissions will be made on whichever of the three bands provides the best propagation to Europe. The last two weekends of May and the first two of June will find the emphasis on South America. Again, the band selected will be the one offering the best signal into the target area.

The frequencies used for these experiments are 10.140, 18.108, and 24.930 MHz, with an effective radiated power (erp) of 30 Watts. The frequencies may change without notice. To QSL or to obtain further information, contact R. P. Haviland W4MB, 2100 S. Nova Road, Box 45, Daytona Beach FL 32019.

But what about the governments, you ask? Why aren't they spending more money on schools? It's obvious to us that the way out of many of the problems they have in these third-world countries requires education. . .and that, even with a good education available, it is going to take several generations before things are able to change significantly.

You have to understand that in a country where there are very few educated people, you have a special political problem. The head of the country, whether he is a king, president, or dictator, stays in power by virtue of his taking care of those who are supporting him. He, and they, are primarily involved in two pursuits. . .staying in power and getting all that they can from the situation. Thus there is little interest or money available for long-range projects such as education.

When do-good organizations or countries can be talked into sending money for projects, the money goes almost entirely to the politicians, not to the people. These governments laugh at the countries which are suckered into sending money. . .all the while asking for more and more.

Countries such as Jordan, where the king takes a real interest in his people and invests money and time in their education, are few. The instability of the other countries makes it impractical for their leaders to invest in anything but their own short-term enrichment.

Thus it is going to be almost impossible to get much in the way of official encouragement when it comes to developing amateur radio in most of the third-world countries. The visiting amateur can keep an eye out for those few children of the elite who might benefit from exposure to the hobby and try to get them started. They at least will have the possibility of getting enough education to be able to grasp the basics. And they have the opportunity to go abroad and further their education. The more you can get to some of these kids, the better shape amateur radio will be in in that country. This will eventually be reflected at conferences in Geneva.

Remember, too, that these kids may grow up to be the leaders of the country in ten years or

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so. Perhaps in another generation it will be possible to do more with amateur radio. There are some hints at better and cheaper educational systems which could eventually benefit these small, poor countries, making it possible for kids to surmount the terrible conditions under which they are living. With amateur-radio-oriented leaders, who knows?

BLITZ CODE LEARNING

Letters from readers indicate that it has been a while since I've written about Morse code. I guess I should have thought about that, because when I talk at hamfests I find that most of those present are not really aware of what is involved with learning the code. Some myths have developed which need explaining.

The historical system for teaching the code is to start people off with the individual characters, teaching them the dot and dash equivalents of each letter, number, and punctuation mark. Then the code is sent very slowly and people try to remember the appropriate character to go with the dot and dash combination.

This process is speeded up gradually until one reaches a plateau, where the increase in copying speed suddenly stops . . .often for a long and discouraging period of time. This is when we lose an estimated 90% of our prospective hams. At around ten words per minute, one finds that the brain no longer will work fast enough to hear the sound, translate it into dots and dashes, look the combination up in a table in the mind, and write it down.

This plateau holds fast until the person develops a completely new way of translating the code. With some people, this is not difficult. With others, it is virtually impossible. The system which permits the breaking of the plateau has to do with hearing the code groups as sound patterns and having them translated into writing or typing on the subconscious level. If you have to think, you can't really copy code.

Modern brain research shows us that the plateau results from the limitations on brain speed in shifting information from the left to the right part of the brain. . .and back. We get up

Continued on page 117

Well . . . I Can Dream, Can't I? **by Bandel Linn K4PP**

"You have scored higher in the contest than anyone else in history! President Reagan wants you to be a White House guest for two weeks!"

Reader Service for facing page ↙345↗

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The TR7A and R7A offer performance and versatility for those who demand the ultimate!

TR7A Transceiver

• **CONTINUOUS FREQUENCY COVERAGE** — 1.5 to 30 MHz full receive coverage. The optional AUX7 provides 0 to 1.5 MHz receive plus transmit coverage of 1.8 to 30 MHz, for future Amateur bands, MARS, Embassy, Government or Commercial frequencies (proper authorization required).

• **Full Passband Tuning (PBT)** enhances use of high rejection 8-pole crystal filters.

New! **Both 2.3 kHz ssb and 500 Hz cw crystal filters, and 9 kHz a-m selectivity are standard,** plus provisions for two additional filters. These 8-pole crystal filters in conjunction with careful mechanical/electrical design result in realizable ultimate rejection in excess of 100 dB.

New! **The very effective NB7 Noise Blanker is now standard.**

New! **Built in lightning protection** avoids damage to solid-state components from lightning induced transients.

New! **Mic audio available** on rear panel to facilitate phone patch connection.

• **State-of-the-art design** combining solid-state PA, up-conversion, high-level double balanced 1st mixer and frequency synthesis provided a no tune-up, broadband, high dynamic range transceiver.

R7A Receiver

• **CONTINUOUS NO COMPROMISE 0 to 30 MHz frequency coverage.**

• **Full passband tuning (PBT).**

New! **NB7A Noise Blanker supplied as standard.**

• **State-of-the-Art features** of the TR7A, plus added flexibility with a low noise 10 dB rf amplifier.

New! **Standard ultimate selectivity choices** include the supplied 2.3 kHz ssb and 500 Hz cw crystal filters, and 9 kHz a-m selectivity. Capability for three accessory crystal filters plus the two supplied, including 300 Hz, 1.8 kHz, 4 kHz, and 6 kHz. The 4 kHz filter, when used with the R7A's Synchro-Phase a-m detector, provides a-m reception with greater frequency response within a narrower bandwidth than conventional a-m detection, and sideband selection to minimize interference potential.

• **Front panel pushbutton control** of rf preamp, a-m/ssb detector, speaker ON/OFF switch, i-f notch filter, reference-derived calibrator signal, three agc release times (plus AGC OFF), integral 150 MHz frequency counter/digital readout for external use, and Receiver Incremental Tuning (RIT).

The "Twins" System

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* Patent pending

New Drake TR5 Transceiver

far above average!

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The TR5 and all Drake Transceivers, are backed by the best in engineering. The TR5 is the result of an extensive engineering effort, combining proven past techniques and ideas with new state of the art concepts.

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Pacific Odyssey

—the Kingman/Palmyra adventure

Kingman; Palmyra. For most hams, these are names which simply mean two new countries, new callsigns, necessary on the road to the DXCC Honor Roll. But to me, Kingman/Palmyra means the most physically demanding and mentally trying of all the DXpeditions I've ever taken part in. Located nearly one thousand miles south of the Hawaiian Islands, these uninhabited coral islets are among the most remote and difficult places to get to in the world.

Born out of a rag-chew session between Harry Mead VK2BJL and myself while my ship, the sailing yacht *Banyandah*, was en route to Japan early in 1980, Kingman/Palmyra (K/P) was to be just one of many DX locations planned in a grand transpacific DXpedition spree for 1981. Originally, Harry (of Mellish VK9ZR and Spratly 1S1DX fame) was to organize operators, licenses, and financial backing for a series of DXpeditions through the Pacific. Locations would include Kingman/Palmyra, Samoa, Tokelau, Kermadec, and a grand finale back where it all began, Mellish Reef.

During numerous rag-chew sessions spanning most of 1980, our plans

The ultimate Field Day site? AD0S/KH5/K.

solidified; *Banyandah* was to sail to Hawaii early in 1981, outfit herself with complete base-camp equipment, and be ready for the first group of operators by spring. Unfortunately, Harry's time to organize such a massive undertaking diminished as his electronic repair business in Sydney grew, and by late 1980 it became obvious that he would not be able to help on the first leg of this epic adventure.

At that time, the thirty-eight foot *Banyandah* was in the mid-north Pacific, battling heavy seas and gale-force winds on an early-winter crossing from Japan to Hawaii. It appeared that K/P would be an all-American operation, so I turned to my good friend, Karl Jensen KJ7B, in Seattle for help. With his usual efficiency, Karl put the word out through all the DX clubs and bulletins while spreading it across the airwaves. The initial response for the three operators needed was terrific; within a week he had a two-page list of potential candidates. But these glad tidings were short-lived; after the full requirements were explained to each candidate, all but two dropped out. To some, the three-thousand-dollar financial commitment was too steep (although as full-scale DXpeditions go, it was cheap). But to all, the real problem lay in the enormous time required to complete the two operations and make the 2,300-mile voyage. Not many people can afford thirty-five to forty days away from family or employer.

Upon our arrival in Honolulu in early December, we still had only two operators willing to challenge K/P. One, the eventual DX King of Kingman, was a quiet, family man from Minnesota. George Carleton AD0S had a burning desire to try his hand at big-time DXing. In our chats, enthusiasm seemed to ooze from his every rf wave. He was a social worker at one of the state hospitals back in Bremer, Minnesota. A plodder, a converted CB operator, he took to the challenge of DXing like a big gun from W6-land. George and his friends outgrew the local radio club when they met resistance for more DX activities. They formed their own club, the Paul Bunyan Wireless Association, immediately entered every club contest around, and offered night courses for future hams.

George and I were so diametrically opposite in backgrounds that we immediately formed a fast friendship. While I've always been a globe-traveling gypsy, working and living in almost every part of the world, George had never left his native mid-America. He married his childhood sweetheart, stuck with his original employment, and carved a homestead out of thirty acres of rural forested land.

The other operator, the third corner of the triangle, was a fine and proven contest operator from California. Kingman was his dream and an allband operation his goal. More about him later.

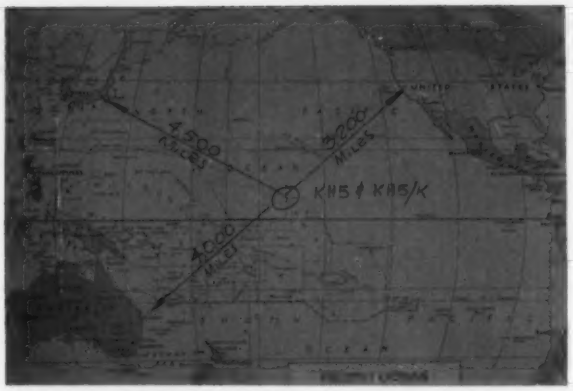
As the New Year rolled in, *Banyandah* lay under the highrises at Waikiki and we still had four months of preparations before us. A daily planning session was set up on 15m, with Karl KJ7B acting as the group's central coordinator. Tasks were assigned, with one operator to solicit equipment from manufacturers, the other to solicit financial aid and sponsors. My wife, Judith, and I started the laborious chore of purchasing the numerous supplies and modifying our ship to hold them.

For the base camp, we purchased two large Coleman tents, three folding tables and chairs, a propane cooker, pots and pans, dishes, water containers, sleeping bags and air mattresses, flashlights and internal lighting, all with spares and backups. In other words, our list included everything necessary to exist on a bare pile of shells in the middle of the ocean. On the critical power plant side, we chose the best: two Onan 2.5-kW portable gasoline generators modified especially with automatic oil feeders. They were expensive, but they came with built-in fuel pump, oil pressure pump, and a robust cast-iron engine. A selection of spares also was taken so that any breakdown could be remedied, including a broken crank rod. Hundreds of other items also were loaded aboard for the base camp: large-capacity plastic fuel drums, funnels, fuel transfer pumps, separate power leads for each station, and home-made twenty-seven foot push-up towers with four-foot long stainless steel anchoring stakes.

From left to right: George AD0S, Judith Binder, the author, and Bill W6HTH, aboard the S.Y. Banyandah *before departing for Kingman.*

And let's not forget the food. Case after case came aboard as Judith returned from her forays into Honolulu's markets. Can you imagine the quantity and variety necessary to feed five adults plus our two children for five weeks without a supermarket in sight for a thousand miles?

On the electronics side, matters were not progressing as smoothly. Manufacturers' budgets were getting tighter and tighter. In the past, outright donations



Go to Hawaii and take a left—Kingman is the first atoll on your right.

Bill W6HTH/KH6 and the author's sons, Jason and Jerome, relax in the Pacific sunshine.

could have been expected—or at least the loan of equipment—but this year all the major equipment producers were willing only to sell their goods at dealer cost. We were still short the third operator, and hence money was tight. George suggested that he buy one Wilson tribander, the System 33 with 40m add-on on the condition that the next group, the ZM7 group, purchase a similar beam; then both groups could share them. For a third antenna, one for low-band operation, George would bring his DenTron doublet. By March, all equipment except the transceivers was either on board or en route.

As one equipment manufacturer after another refused our requests for the loan of equipment, George offered to break down his home station and send it along with borrowed equipment from his newly-formed club. A generous offer; after all, anything can happen to sensitive gear carted halfway around the world by airplane, sailing yacht, and dingy. Not to mention the hazards of operating it in an exposed salt-laden environment under the rigors of portable power. But equipment was needed, or we wouldn't be going anywhere.

One night George started thinking about how this expedition was shaping up to be an all-American DXpedition. We had Onan generators, Coleman tents, Wilson antennas, and American operators—and Kingman/Palmyra is American. The light must have blinked on in his brain, for early the next morning he contacted the Ten-Tec Corporation in Tennessee and put forth his request. At last we had found a manufacturer eager to help, for they offered the outright loan of three complete stations with power supplies and outboard vfos in their Omni-C range. Like a runner clearing the final hurdle, we all let out a collective sigh of relief. A departure date was set, air travel tickets were purchased, and *Banyandah* loaded aboard the last supplies: gasoline, diesel fuel, and engine oil.

We were now a going concern. Permissions had been granted and every bit of gear had been arranged, but we still had only two financial members, neither of whom could afford a red cent more. As a last ditch effort, an alternate financial arrangement was offered: *Banyandah* would chip in the remaining third share on the proviso that the boat be paid back first from any forthcoming contributions. This was applauded as an excellent solution and was readily accepted by the other two members.

I must admit that I was not as enthusiastic about it as the others since our past DXpeditions had always been straight-out charters. But my wife and I are avid adventurers who get personal satisfaction in overcoming obstacles—and we're a little DX-mad to boot. We had a sincere desire to see the K/P duo reactivated. Besides, we firmly believed that the amateurs of the world would support our expedition—a mistaken belief which proved costly.

All went well for several weeks; George chopped extra wood to warm his house in his absence, the other operator cleared his desk, and we took a much needed rest with our two young sons—for we had been on the go since our grueling, forty-five-day crossing of the north Pacific.

When the disaster struck, it fell like a meteorite from the heavens. Our California operator dropped out when there were only two weeks to go before departure. Great! Thousands of dollars and hundreds of hours of labor and planning down the drain since two men cannot set up DX stations at a place as dangerous and physically difficult as Kingman, nor can they operate and survive with one man ashore and the other minding the boat.

We definitely had a serious problem! George's reaction was as I expected: "We'll do it alone!" His faith was like an injection of adrenaline into my waning spirit. But in the end it was a Honolulu amateur who came to our rescue. Bill Boykin W6HTH/KH6 already had stood by us during the hectic preparations in Honolulu. He had helped coordinate and track down equipment; he had run errands and loaned us his car for the months that it all took.

Bill, a retired old salt from the Navy, is an ex-electronics technician who had been stationed in many a foreign port. He was not the typical DX hound since his true love was six meters. But as each new item was stored aboard, I could see the dream germinate and grow in his eyes: a long sea voyage across the balmy trade winds to a wild and rarely visited patch of land, the excitement of setting up the beams and stations, and, the topper, his six-meter beam proudly atop the tallest tower! Time wasn't his problem, but money was. He could not offer any financial support, so instead he readily volunteered his time, muscles,

"all other gear gave us trouble... the TEN-TECs just kept working great."

1981-82
Trans Pacific DX Expedition
used TEN-TEC OMNI-C transceivers.

KINGMAN REEF, PALMYRA, TOKELAU — 33,000 contacts without a miss.

As George Carleton (ADØS ex KH5K) said in a letter to TEN-TEC... *"12,100 QSO's from Kingman, 8100 for me, 3100 in the first sitting with the rig on a continuous 33 hours except for 2 minute gas breaks... all other gear gave us trouble due to salt spray – the TEN-TECs just kept working great.*

"This is the most QSO's ever from Kingman and all were barefoot. A few times generators ran out of gas during rainstorms with rigs operating on TX... no problem with voltage drop, and no damage. No tuners were used... only your rigs and (antennas). The wind blew continuously from 20 knots to 50-60 knots and we literally had to open the tent to let the rain out, salt water and spray everywhere, watches quit, keyers and linear (other brands) quit after the first QSO – arcing due to salt spray, but the TEN-TECs never even got warm when the tent was around 100°F.

"... American gear is best."

The TEN-TEC OMNI-Cs went on to serve on Palmyra and Tokelau with equally impressive results and we thank the group for their letters—we couldn't have said it better.

The spectacular performance of the TEN-TEC OMNI-C results from these fine features:

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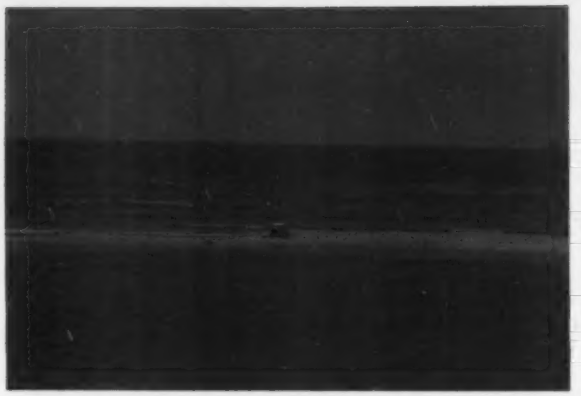


The "country" of Kingman is about seventy-five yards long and towers five feet above sea level in calm weather.

Accommodations on Kingman Reef were anything but luxurious, but George and Bill didn't seem to mind.

and skills, and replaced our California operator.

With that I faced another difficult decision: *Banyandah* lay at the dockside fully equipped and ready to go; our dollars and hours of labor had already been expended, but financially we were in a mess. What should I do? Our now-dropped-out operator was to have arranged sponsors, and now there was no time. I had had no experience with the returns from QSL cards but believed (like so many) that a green stamp per envelope was the minimum to be expected. Well, if that was the case, we'd just have to work that many more stations.

The night of April 7th was cool and clear; the twin volcanic peaks of Mauna Loa and Mauna Kea stood behind us, finely etched by the intense curtain of starlight. At their base, where the sea greets these giants, lay the tiny pleasure-boat harbor of Honakahou, carved out of a solid river of lava. *Banyandah* lay at dockside like a fine race horse waiting in the gates. A child-like atmosphere of excitement and anticipation prevailed as the last baskets of papayas, pineapples, and stalks of bananas were lashed into place. A final tug on the ropes securing the drums of gasoline, and everything was secure. The ship's diesel engine was started, roaring into life and shattering the quiet loneliness of the basin. George and Bill dropped the mooring lines and, amid the shouts of "Bon Voyage!", "Safe journey!", and "Good DXing!", *Banyandah* glided smoothly away.

Sweet, cool air was the first hint of the trade winds. Each gust was a bit stronger, and when *Banyandah's* lee rail dipped, the engine was secured. Finally, it was time to relax. The boat's automatic wind-steering device was holding a true course south while the lights of Hawaii's Kona Coast diminished astern. At last we were under way, severed from civilization. The memory of the months of toil and frustration seemed to melt with the miles passing under our keel.

The smooth, fast movement of the boat, the black sky bright with stars, and the sea glowing with amazing bits of bioluminescence created a mood so perfect, a mood which lasted the entire voyage, that success could be tasted in the air. We chatted the night away, George and Bill both refusing sleep for fear of losing the magic of the moment. Judith, the more practical one, helped our children (Jason and Jerome) get to bed and then brewed a fresh pot of coffee for the night watch before turning in. Our normal routine was to split the long night hours into two watches, dusk to midnight and midnight to dawn. During the daylight hours, watches were more relaxed as the world's commercial shipping has a better chance of seeing our tiny craft.

At daybreak, Ka Lae, the most southern point of the United States, could just be seen through the haze, while the ship's log held steady at six and a half knots. By 1000 hours, we had our last sight of land and we were completely alone, a white dot at the center of a disk of blue.

Days merged into nights and back into day, each the same and yet somehow quite different. We had time to study each cloud, each wind swell; we had time to talk or to be alone with our private thoughts. We caught fish on our constantly trailing lure—mostly small bonito. But sometimes a powerful dolphin fish, a mahimahi, would strike and the battle would be on. This fine-tasting fish with its firm white flesh would battle with all its immense strength until at last it could be hauled aboard flapping and jumping, changing its body color from yellow through green to an electric blue until death took it and it turned to silver.

Each noon, after my celestial sight, I would plot our position on the chart. Each day, the tiny dot marking our position would inch its way closer to the cross marked Kingman Reef as jumps of 136 miles, 138 miles, and, once, 144 miles were plotted. After seven full days of sailing, we were only fifty miles away from our goal. The week had been perfect: fifteen-knot northeast winds, sunny days, and starry nights. No ships, airplanes, or other man-made objects had been sighted.

Originally, we had set sail for, first, the palm-clad islands of Palmyra, and *then* Kingman, since finding that five-foot-high speck after a one-thousand-mile ocean voyage would require perfect conditions and the utmost skill. But Kingman was the real challenge. And by the halfway point, George had convinced me that it required a fresh and eager group to do it justice and should come first. I altered our course to make the attempt. But on that last evening, alone on watch, as the sky darkened with the approach of rain clouds, I began to doubt the wisdom of my choice.

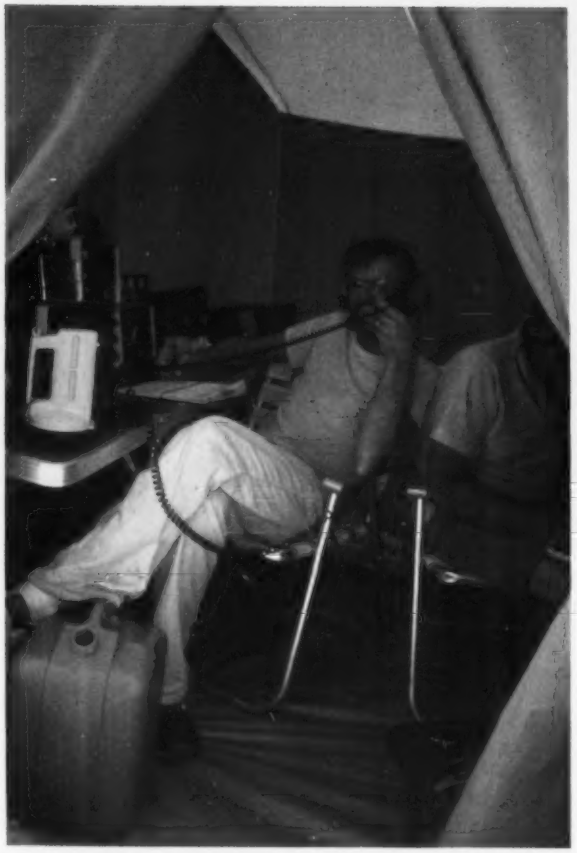
Ocean currents are

strange forces. For thousands of miles they will remain constant, flowing in one direction at a reliable rate, but upon an approach to land, with the sea bottom suddenly rising, they become unpredictable. To make matters worse, somewhere in this area we would leave one current and enter the world's strangest current, the equatorial countercurrent. This narrow band of water defies all sense by moving directly opposite to the normal trade winds. Its northern limit shifts back and forth across the region at a whim of some unseen force, causing distress among all ship captains who sail this area. Normally, a very wide berth would be given to Kingman, but it was my job to find it safely.

Soon the wind freshened and swung ominously to the southeast. Rain began to fall. It increased until my vision was down to a scant fifty feet. But *Banyandah* heedlessly sailed on, blindly cutting through the water while closing the distance between us and one of this ocean's worst navigational hazards. As the miles ticked off, I held my breath and prayed that my instruments and sights were correct and that our luck would hold. Every few minutes I poked my head above the spray dodger and peered into the rain and gloom, expecting to see that flash of white signalling breakers and destruction.

By 0400 hours, I had had enough and dropped the headsail and mizzen. Quietly, the ship came into the wind, gently rocking in the swell. I woke Judith and crawled into the bunk. "Wake me if the stars show," I said, and immediately fell asleep.

Just before 0600, I was up again. The storm had passed and the first tinges of pink lit the eastern horizon. Quickly Judith and



George ADØS, making one of the 12,176 KH5/K QSOs.

I measured the angle between horizon and our favorite navigational stars, jotting down the exact time of each sight. My voice calling out "Mark!" at each sight must have woken George and Bill; sleep was still in their eyes when they crawled out of the stern cabin. George scanned the blank horizon and said with a grin, "No trees in sight yet." And we all laughed since this was the Minnesotan's usual way of greeting a new day at sea.

The star sights didn't take long to work out and showed that we were still thirty miles from that danger which had seemed so near in the rain and the dark. The current had worked its magic and had pushed us away instead of closer. The wind had gone with the passing rain, leaving a calm sea and a bright hot day. Now under power, we continued on a new heading. A scum line was passed—a convergence of currents trapping bits of floating plastic and discarded light bulbs, all alive with small crabs and tiny fish. All morning I tracked the sun with my sextant, and my chart became a mess of intersecting position lines, each a bit closer. By the time the sun reached its azimuth we were very close, and conditions were perfect for a landing.

At 1300 hours I climbed our forty-five-foot mast and scanned the horizon. The sea was flat and calm, the horizon sharp but empty. At 1400, with (supposedly) only six miles to go, I climbed again. There! Just near the edge of the world a vague splash of white showed for a moment and I couldn't believe my luck. The breakers of Kingman Reef were in sight! At deck level, the rest of the crew jumped up and ran to the rail, but nothing could be seen. For the next hour they strained for their first glimpse. Finally, with only two miles to go, George let out a whoop of delight. The rest happened fast. One moment a flat sea, the next a long line of small breakers off our beam and the sea changed from deep blue to aquamarine. Coral heads seemed to rush up to meet us. As we crossed the sunken reef, they were plainly visible even though the depth meter recorded seventy-five feet.

Portable KH5/K first appeared as a heap of brilliant yellow-white sand, sterile and completely devoid of vegetation. The ridge of fine coral rubble and upturned coral boulders was the result of thousands, maybe millions, of years of the sea crashing against the outer barrier reef and washing the broken bits of coral and dead shells into a pile. Excitement ran high as we toured the area in the lee of the cay, taking soundings for anchoring.

It was then that we met the first evidence of Kingman's wildness. Although the depth recorder showed a steady bottom, it was over two hundred feet down! And it was all the same, right up to the perpendicular cliff of reef. At a quarter mile off, I said a silent prayer and lowered the anchor down into the blue, paying out every inch of warp, shaking my head as it slithered over the bow rollers and disappeared from sight.

The cay seemed to grow smaller instead of bigger as we approached in our ten-foot aluminum dingy. Soon it could be seen that its side was steep and not the long gentle slope we had first seen. Kingman was not smooth sand but an im-

Land ho! The good ship Banyandah *makes for a landfall on Palmyra.*

The base of operations on Palmyra was the green building at the center of this idyllic scene.

mense pile of six-inch-wide clam shells bleached white by the intense tropical sun. By crawling on all fours we reached the summit, and my heart sank even further when I realized that this forsaken pile of shells went hardly six feet across at the top before tumbling down again into the sea.

We walked the full length of the cay—all seventy-five yards of it. Decomposed bits of wire and the remains of a vertical's base marked the spot of the last DXpedition, probably Kingman's last human visitors. On the northwest end, nature had scalloped out a hollow with a flat area about ten feet square, backed by a near-vertical wall of shells and large coral rock. It looked tailor-made for the smaller of our two tents. Its only threat was the water, which lay only two feet away. Was this high or low tide? A quick look at the debris line indicated that it was nearly high. I mentioned that the hollow might be swept by swells if the sea got nasty. George's only comment was that he didn't mind getting his feet wet as long as he stayed on the air. And so the smaller tent was set up there—a move which later proved to be a key to our success.

Tropical night comes quickly, and the fiery reds and oranges of twilight are short-lived. Soon it became impossible, even dangerous, to carry on in the half-light, and reluctantly we returned to *Banyandah*. Once "home," Judith prepared a celebration landfall and birthday dinner, for we just happened to land on her birthday, April 15th. A special dining table was set up in the cockpit and all our "at anchor" crockery was laid out. That night we rode a wave of euphoria.

At dawn the next morning, the boat came alive as we began the back-breaking job of hauling equipment ashore. Each item was unloaded into one of three piles: power, tent, or antenna. By mid-morning the bulk of it was there, and Bill and George started assembling the beams while I lugged generator supplies to the top of the ridge and established the power plant. For a while, Jason and Jerome ran little errands, but boredom set in and they disappeared down the cay, running from one pile of flotsam to another, beachcombing the most untouched beach in the world.

They returned dragging a large pink fishing float and a long barnacle-encrusted length of bamboo. Thirty minutes later Old Glory was raised, fluttering proudly from its bamboo staff supported at the surf line by a pile of dead coral boulders. Little did we know that storms were to snap that staff like a match stick three times before we left!

Noon was approaching, and the day was becoming alarmingly hot and airless. Worst of all, our ankles started to swell and turn black and blue from numerous painful jabs from the saucer-shaped shells. We cautioned each other about heat exhaustion, but DX fever was growing inside of us. The tribander with the 40m add-on was put right out in the low-tide area of the reef. The other tower held both a tribander and the six-meter beam. Raising it was a hellish job, and several moments of near-disaster passed before the guys were finally secured. The rest went much like any Field Day back home. The two stations were set up, coax and power connections were made, and the beams were checked for swr. Everthing looked fine; Kingman was ready.

At 0057Z April 17, George made the first contact using the callsign AD0S/KH5/K. A huge grin spread across his face as he spoke on 15 meters with his life-long friend Mike AF0T, back in Bremer, Minnesota. Mike surely deserved that first contact. He was an unseen member of our team whose cheerful encouragement and traffic patches eased the loneliness of the thousands of miles.

After Mike it was first come, first served. Immediately the pileup swelled into a gigantic opening day beast, and George's eyes bulged with the onslaught of decibels. The last Kingman group had not lasted long, and no one was going to miss this chance. George lit a fresh cigarette, let out a deep sigh, and called, "QRZ, Kingman Reef calling."

We had never planned our on-shore operation. In the first place, plans and schedules seldom work out when you are at a really rare and hard-to-get place. All we knew was that George was to be the king DXer. It was obvious; Bill had never beat his way through a pileup before and had come along to help set up. And although I had been on several really big DXpeditions, I had always been too busy running supplies, maintaining equipment, and minding the boat to do much operating.

Undoubtedly George was a novice, the new boy, the country operator, but he had a desire so indominable that I knew nothing would stop him—and nothing did. After those first few moments of hesita-

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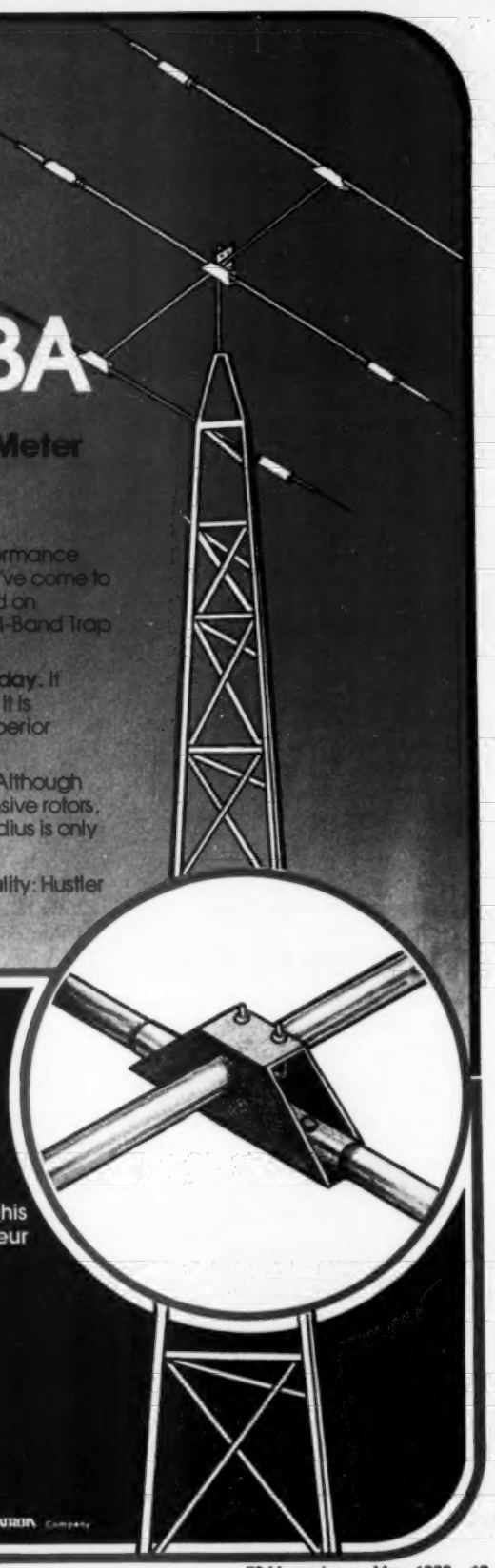

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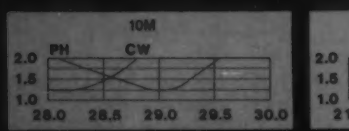

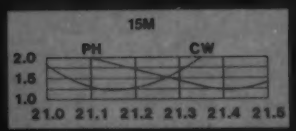

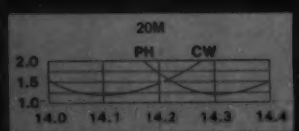

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Amid Palmyra's lush tropical vegetation, a tribander takes shape.

The operating position at AD0S/KH5 with George and Bill hard at it.

tion, he sat in his chair making contact after contact nonstop, giving a new country to over three thousand stations before finally collapsing on the floor of the tent, ending forty-eight grueling hours without sleep. He awoke three hours later when I came ashore with fresh coffee, a hot meal, and a new supply of gasoline. A couple of hoarse comments passed between us, and after a sip of coffee and a new smoke, it was "CQ hello CQ," and he was back on the air, his breakfast untouched and growing cold beside the rig.

Yes, Kingman was a tough one. Tougher than Mellish or Spratly, and much harder than Palmyra or Tokelau. Not only was our foothold precarious, but the weather was always unpredictable, changing from sunshine and twenty-mph trade winds to storms which hit quickly after building for thousands of miles of open ocean.

The most frightening of these storms struck our first night ashore. The day had been quiet, but as the sun set, a breeze sprang up from the clear night sky. At first it was a cooling relief, but soon it began to build in jumps with gusts of thirty-five knots. As it increased, so did the tide until just at high water the horizon darkened with the advance of brooding black thunderheads and the real storm began. The wind howled past gale force and the sea went crazy. Huge waves crashed over the barrier reef and pounded against our puny coral rock barricade. Salt-laden spume flew against the tent sides and was driven through by the torrent of rain. The inside of the tent was a horror scene. Gear was drenched and pools of water formed at our feet. At the storm's fullest fury, we were forced to bodily support the tent, and the harsh lighting showed our strain and fright as each man expected to be catapulted into the nearby lagoon by the next blast or breaker. Fortunately, the storm passed at dawn, and I hurriedly brought the larger tent ashore. Guy lines were doubled or tripled. Coral boulders were placed inside along the tent's periphery with an equal number around the outside to hold the tent in place.

Band conditions were fantastic with the big three always open to somewhere. The Ten-Tec Omni-C transceivers performed well, with such powerful barefoot signals that they controlled the pileups with ease. But that is not to say that we didn't have equipment problems. Bill had forgotten his earphones, and mine were so uncomfortable and tinny that we were forced to go without. George's Autek filter shorted out during the first night's storm, as did his new DenTron linear. He straightened out the Autek by changing a couple of the ICs, but the DenTron never even got looked at.

The biggest problem was the wash-over between the two stations. At first we thought it was insufficient grounding and ran extra wires into the sea. Then we blamed the broadness of the tribanders, but in the end we accepted it as a shortcoming in the transceivers. Most of the time it wasn't a problem, since George had priority with his skill at pulling callsigns out. At the worst times, it was terribly frustrating for Bill and me as we'd wait and then yell, "Go now! He's not transmitting!"

Considering that this was Kingman and one of the most difficult DX locations in the world, everything went amazingly well. All bands were covered except 160 meters, which was absolutely dead. Once again it was proven to me that the time used to search out the twenty-seven 80-meter and the ten 6-meter contacts would have been far better used to give many other stations the new country on the higher bands. More time was lost with inconsiderate operators who grabbed two, three, and even four contacts on the same band and mode, stealing the contact from hundreds of others. Why can't all DX operators learn that expedition time is precious? Asking for QSL information and forced chit-chat during a pileup only breaks the stride of the operator. They could have listened a while for QSL and band-change information.

We also had the usual number of weirdos fanning their egos by whistling, mooing, and breathing heavily into the mike. Plus we had one particular crazy who obscenely attacked Bill and then George. It saddened and embarrassed us to hear such crude talk, and, as it happened, both my wife and children were listening, too!

On the brighter side, US operators proved the easiest to work as long as we worked each district fairly. JAs and European operators were frantic and sometimes unruly, while the South Americans politely got their share. And lastly, my cobbers from down under were still the same: callsign, name, signal report, and 73, all at a two-a-minute rate.

A total of 12,176 QSOs were logged. The last one went into the book at 1457Z April 22, five days and four-

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teen hours after we began. Not surprisingly, it was between George and Mike AFØT, with a "job well done" message from Minnesota. It *had* been a job well done, for George had logged 66% of the total contacts. His beam heading had never moved, and a whopping 80% of his contacts were with North Americans. The total breakdown per area was: North America—74%, JA—15%, VK/ZL—4%, and the rest of the world—7%.

We shut down in the wee hours of Wednesday morning, extremely happy and proud of our combined efforts. We sat at the door of the tent and watched the dawn break over the stark beauty of Kingman—we felt an immense bond of comradeship. We planned to spend one day breaking camp and repacking the boat, and sail the following day for Palmyra. That would allow us enough time to be established at Palmyra for the weekend.

And that's just what we did. After the last box came aboard at midday, George and Bill collapsed. They woke briefly for dinner and then hit the sack once more to sleep the night through. Early pre-dawn Thursday morning, the hundreds of pounds of anchor and chain slowly rose from the ocean's depths, needing three hours of coaxing by the ship's anchor winch. By first light we were under sail and heading for Palmyra, forty-five miles away.

That sail was terrible, and seas knocked us about, but by twilight we were in. We located the airstrip and the crashed plane from a previous ill-fated expedition. We moored right alongside the sea-plane ramp and stepped directly on shore. It was a great DX spot and we would have really appreciated it had it been our first or only stop. But it wasn't, and we were simply DXed out, spent, and a little homesick, with a two-week voyage separating us from family and friends. Furthermore, we didn't expect much of a demand since the previous visitor had logged big thousands of contacts. For us, there was simply no challenge at Palmyra; it appeared nothing more than a deserted holiday camp—quite a comedown after the herculean task of activating Kingman.

The S.Y. Banyandah *in search of new adventures.*

Setting up camp the next morning was a breeze. We merely walked along the ramp with our gear, boat to shack—the old bunk house for flying boat service personnel. We ran our power supply straight into the building's fused junction box and had lighting at the flick of a switch. An old refrigerator also came to life and soon we even had cold beer. Ah! What a life! A gorgeous view out onto a peaceful lagoon ringed by islands alive with swaying palm trees and a DX station ready to tackle any pileup. Unfortunately, our mood, the mosquitos, and the rats which infested our shack all combined to sour the dream.

George and Bill were on the air by 2116Z that same morning—after a mere four hours to set up. The pileups were there, all right, but not the kind that shoot adrenaline into your veins as you fight to keep them under control. They died out so quickly that we even shut down for dinner.

During the Palmyra mornings, we all relaxed, fished, or explored the islands. In the afternoons and evenings, George and Bill worked DX while Judith and I prepared the boat for the fourteen-hundred-mile voyage to Pago Pago.

Propagation worsened while the longing for home grew stronger; finally, we closed the station after making the last contact at 0341Z April 29. The total number of contacts logged was 5,320. The breakdown per area was almost identical to that for Kingman.

The rest of the adventure was sort of mundane; a celebration dinner that night, a slow and careful packing up of the boat the next day followed by a refreshing final shower from one of the numerous rainwater storage tanks, and then a long sail halfway across the Pacific to American Samoa. For eleven days, the horizon remained empty. No ships, no aircraft, nothing but a fifteen-mile-diameter visible circle of sea. Finally, at 0930 hours on the twelfth day, from Palmyra and the thirty-fourth since leaving Hawaii, the 2,141-foot peak of Matafao on American Samoa pierced the skyline and the great adventure began its last act.

We rounded the island's eastern tip just after lunch and sailed along its southern shore, feasting our eyes on the greens and yellows while savoring the aroma of land. It was a quiet, easy sailing day and George stood in the companionway describing the lush jungle, quaint villages, and dilapidated buses to Gwen, his wife, who was on the patch.

We entered Pago Pago harbor marveling at the beauty of the gorge and holding our noses from the smell of the fish factory. The anchor went down, the authorities were notified, and the vessel was cleared. That night the final rites for this unique experience were held at a nearby restaurant where we stuffed ourselves on steak and salads. Two days later, George and Bill were gone, and the 1981 Kingman/Palmyra DXpedition became a memory.

The expedition cost $10,000 not including airfares, hotel bills, and miscellaneous shore expenses. Of that, $4,740 is still owed to the boat. Most of that will probably have to be written off since our efforts at obtaining post-operation sponsorship died in a flurry of kind words. To date, with nine thousand cards received, little will be left after postage. In fact, we had great plans for a beautiful and dramatic full-color QSL card, a fitting tribute to the achievement, but even this had to be replaced with a two-color card as there just wasn't any money for it.

Nevertheless, it was a true chunk of adventure; it is a memory of achievement, comradeship, and beauty to hold the rest of our lives. And as George recently said, "I don't know when or how, but I'm going to do Kingman again!"

Written on board the S.Y. Banyandah, *Wallis Island, South Pacific, 1981.* ■

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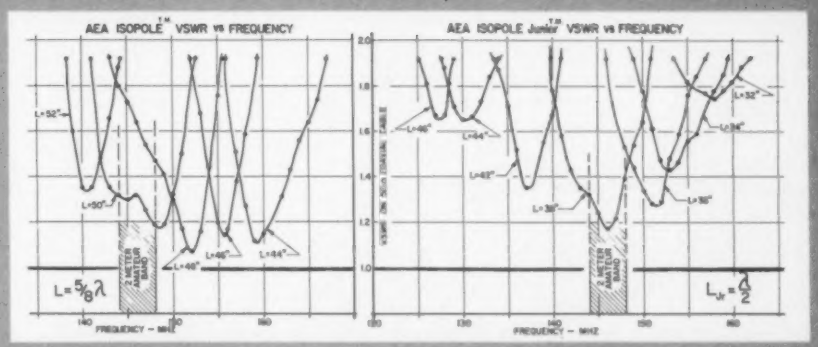

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The 160-meter band, which is in the process of being rediscovered as manufacturers have added the top band to transceivers, poses a special challenge with respect to antenna performance. One of the fascinations of 160 is that it remains the band for which readily-available commercial antennas are not the answer. The situation is further complicated by the fact that an effective 160-meter transmitting antenna is not always a good receiving antenna. Hence, it is often desirable to use a separate receiving antenna. This article describes a specific 160-meter antenna installation with emphasis on the system aspects, as opposed to antenna and circuit design and construction details.

Transmitting Antenna and Ground

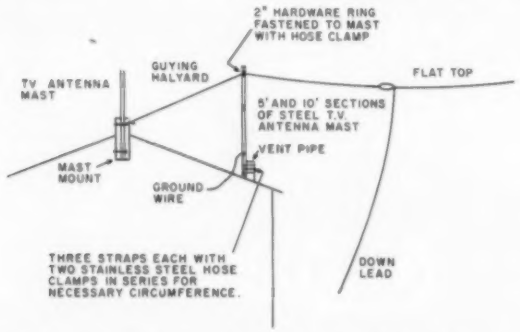
The general objective was to provide an antenna installation for all HF bands with good performance on 160 meters, preferably without a tower, which for a number of reasons is not well suited to my property and house configuration. The property available for the installation provides a straight shot of about 120 feet down a narrow open area surrounded by trees about 50 feet high. Ground conductivity is good in the general area and in the specific location.

Because of its flexibility for allband, all-frequency operation (with a transmatch), and because of its suitability to the property configuration, a quarter-wave (at 160 meters), end-fed, inverted-L was chosen as the primary antenna. The shack end is supported by a guying halyard on a 15-foot steel TV-type antenna mast secured to a vent pipe on the roof of the house. Stainless-steel hose clamps are used to secure the mast to the vent pipe. See Fig. 1. The halyard is tied to a TV antenna mount that happened to be conveniently in line with the vent pipe.

The center of the flat-top is supported by a line stretched across the top of two trees on either side of the antenna run. The far end is supported at a height of about 55 feet with a line over a third tree. The lines are supported high in the trees and their ends are tied around the trunks of the trees at a convenient height a few feet above the ground. No pulleys, weights, or springs are used. The tree limbs themselves act as the flexible elements that give in the wind.

The antenna wire is connected to a transmatch about two feet from a ground-floor window, passes through an antenna insulating panel, rises nearly vertical for about 40 feet, and runs out about 95 feet with the flat-top at an average height of about 50 feet.

A note about antenna halyards: Nylon line is excellent but expensive; polypropylene line is much less expensive but deteriorates quickly in the sunlight; with limited experience of only several months, parachute cord (available at surplus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THREE STRAPS EACH WITH TWO STAINLESS STEEL HOSE CLAMPS IN SERIES FOR NECESSARY CIRCUMFERENCE.
DOWN LEAD

Fig. 1. House-end antenna support. Tension is taken by a halyard tied to a TV antenna mast mount rather than by the bending strength of the inverted-L support mast. Side guys would be a desirable improvement.

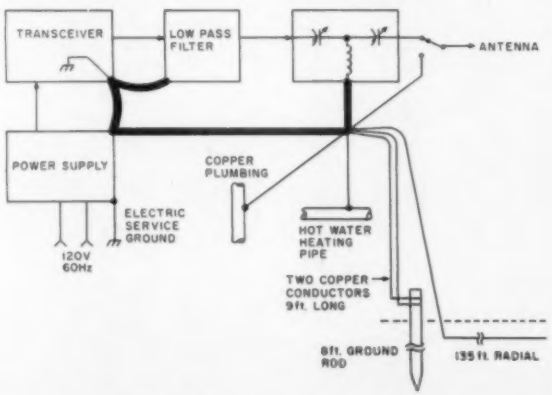

Fig. 2. System ground arrangement.

stores) appears to provide a good, inexpensive solution.

Ground

A quarter-wave antenna requires a low-resistance ground to be an efficient radiator. The station equipment must be properly grounded to keep rf off the equipment chassis and to prevent rf feedback. The grounding arrangement that met these requirements is shown in Fig. 2. The heavy straps shown are all 3/8" braid.

It is common practice to increase radiating efficiency (reduce ground losses) of electrically short antennas by laying quarter-wave conductors out in all directions from the base of the antenna either on or below the ground—the more radials the better. Since in this installation the base of the endfed inverted-L is terminated at the house and because of the narrow width of the lot, even a small number of radials cannot be accommodated. I settled for one 135-foot radial connected to the common ground point inside the window, dropping directly from the window to the ground below and running approximately under and approximately parallel to the horizontal portion of the antenna. The single radial is buried a few inches under the ground to get it out of harm's way.

It did not take long to determine that this antenna and ground combination was a good radiator. However, it left much to be desired as a receiving antenna. Consistently, I was being copied by stations that I could not pull out of the noise. Consistently, the other stations were copying stations that I could not copy. My station was "receiving limited."

Receiving Antenna and Preamplifier

In searching for a better receiving antenna, I came across the 5-foot, single-turn, shielded loop in *The ARRL Antenna Handbook* (see Fig. 3). Much to my surprise and delight, this little loop mounted two feet above the ground and working into a preamplifier proved to be a simple, convenient antenna with superior performance. The loop was made of RG-58/U coax mounted on a 6½-foot wooden dowel mast with light wood cross pieces. The mast was mounted on a TV antenna rotor which was in turn mounted on a 2-foot-square plywood base. RG-58/U was also used for the feedline. With the recent reopening of 160, it would be better to construct the loop and feed using lower-capacitance RG-59/U foam cable. This would provide increased performance across the band.

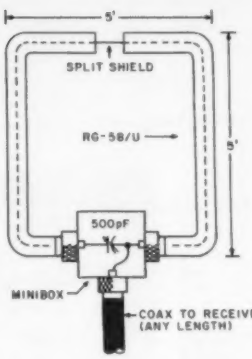

Fig. 3. Loop receiving antenna.

The signal level produced by the loop antenna is quite low but easily can be boosted to an acceptable level with a simple transistor preamplifier. Because the preamp I used was home-built and because there are some associated system ramifications, a description of the circuit is included here (Fig. 4).

This simple preamp was not designed, but rather built from the simplest FET circuit I could find out of

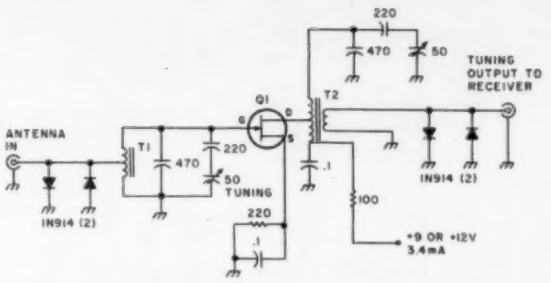

Fig. 4. 160-meter preamplifier. Q1—FET, Radio Shack 276-2036; T1—Amidon T50-2 toroid core, approximately 50 turns (core full), tapped at 6 turns; T2 is the same as T1 except that it is tapped at the center and has a 6-turn link over the ground end.

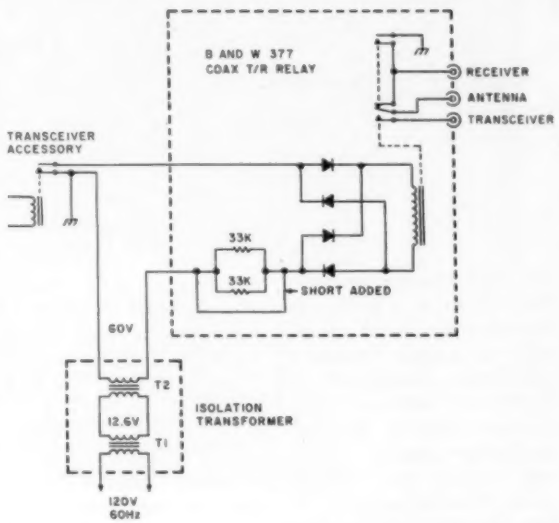

Fig. 5. T-R relay details. T1—Radio Shack 273-1505, 120:12.6 V, 1.2 A; T2—Radio Shack 273-1386, 120:25.2 V, 0.3 A.

available parts. The input and output tuned circuits were arranged to cover 1800 to 1850 kHz. It could undoubtedly be improved, possibly by broad-banding, to eliminate the need for tuning. It provides a gain approaching 20 dB, but in my "brassboard" model is uncomfortably close to oscillation. It performed well enough on the first try that no effort was put into improving it. It would have to be modified to cover more than the 1800-to-1850-kHz portion of the band.

Since this article was first written, the 160-meter band has been opened to 1900 kHz and the loop performance has been improved by replacing the preamp in Fig. 4 with an untuned broadband preamp at the base of and connected directly to the loop.

Note the protective diodes in both the input and output of the preamp. The input is wide open on transmit and there is a danger of transmitting into the output, hence the diode protection on both ends. With 100 Watts into the inverted-L and with the loop antenna about 10 feet from the downlead, a peak audio-frequency signal of 6 volts is developed across the

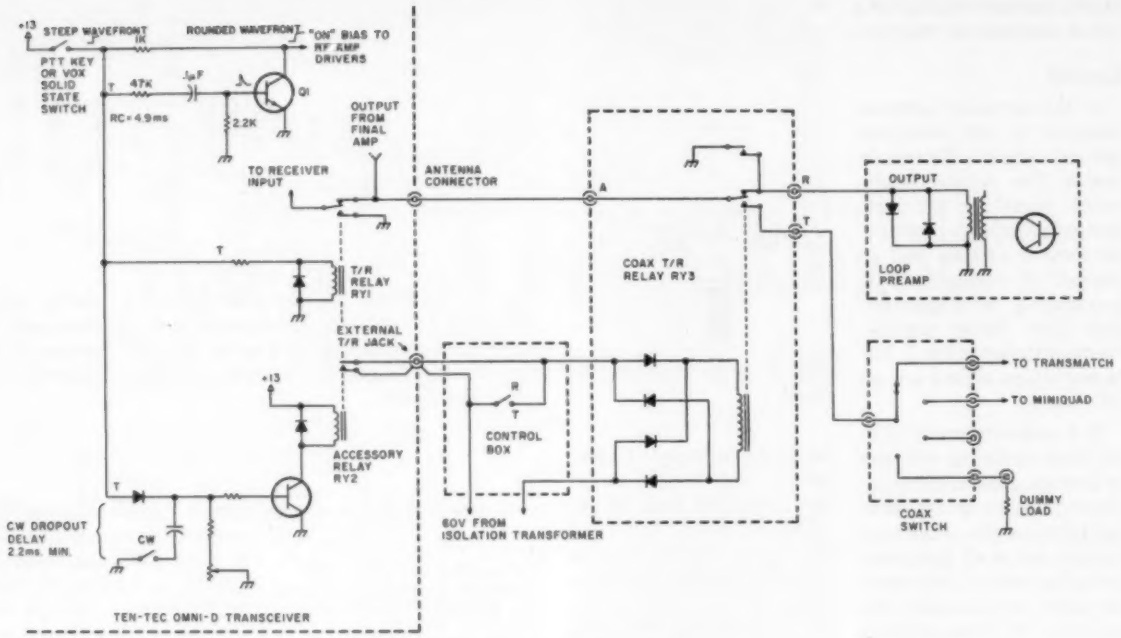

Fig. 6. System functional schematic.

220-Ohm source resistor. This results in a peak current of about 27 mA, equivalent to a peak transistor dissipation of approximately 230 mW. Although not a rigorous analysis, the FET dissipation appears to be well below the 300-mW rating. At a distance of 150 feet, the voltage across the resistor is only a fraction of a volt. In the system arrangement described in a later section, the T-R switching transient into the preamp output causes a 2-volt peak about 8 ms long across the source resistor.

Tuning the loop is simplified because it can be adjusted at ground level. Tuning was accomplished with the length of feedline to be used in operation and with the loop and preamp connected to the receiver. Subsequent experimentation indicated that the loop tuning was affected somewhat by the length of the feedline. A grid-dip meter was used as a signal source. Receiver S-meter readings were observed for incremental adjustments of the loop tuning capacitor until a maximum meter reading was obtained. A 430-pF capacitor was required to tune the 5-foot square of RG-58/U to 1815 kHz.

T-R Relay and Isolation Transformer

Since some surprises were encountered in obtaining satisfactory performance of the T-R relay and associated isolation transformer, these components will be described in some detail. See Fig. 5.

The B & W coaxial T-R relay is rated at 50 to 120 V, 60 kHz. It turned out to be a 28-volt dc relay with series dropping resistors and full-wave rectifying diodes as shown. Since in the system being described the relay was expected to be energized for long periods during operation on other than the 160-meter band, it was considered desirable to operate the relay at the low end of its current rating. The relay would not pull in on 50 volts until the dropping resistors were shorted. With the resistors shorted, the relay operated satisfactorily on 60 volts.

Isolation of the electric service ground is required because one of the transceiver T-R relay contacts is grounded to the chassis. Using two heater transformers back-to-back was less expensive than the purchase of an available, standard-size isolation transformer and provided a convenient means of reducing the voltage to half the line voltage. The original transformer used for T1 was a 300-mA size; *it ran far too hot.* It was determined that although rated for 15-Watt output, it was drawing 7.2 VA at no load (disconnected from T2). In operation with the relay-coil load on continuously, T2 runs cool and T1 runs at about 110° F (40°. above ambient); surprising, but not unacceptable.

System Integration

A functional schematic diagram of the overall antenna system is shown in Fig. 6. The relays are shown in the "R", or "receive," position. The control box located conveniently on the operating desk contains a miniature switch allowing the coax T-R relay to be actuated with the transceiver in receive. In this way, the receiver can be instantaneously switched back and forth between the two antennas for comparison. On other than the 160-meter band, the T-R switch is kept in the "T", or transmit, position and the "transmitting" antenna is used for both transmit and receive.

When the transmitter is keyed, or the PTT or VOX switch is actuated, a 13-volt transmit control voltage (T-voltage) actuates RY1 and RY2. RY1 grounds the receiver input and leaves the final amplifier output connected to the antenna connector. RY2 actuates RY3, which in turn grounds the output of the loop preamp and connects the transceiver to the transmatch. Note that the coil circuit of RY3 is grounded only at the external T-R jack.

At the same time the T voltage is applied to RY1 and RY2, it is applied to the transmitter rf amplifier bias bus through a solid-state delay switch, Q1. The resis-

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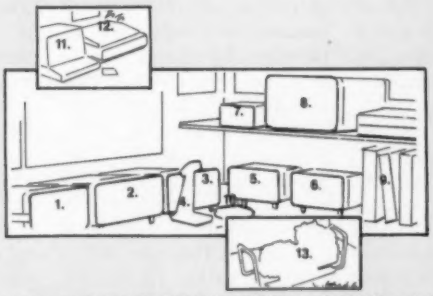

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tor and capacitor in series with the base of Q1 applies a decaying pulse to the base until the capacitor is charged, after which the base voltage returns to zero.

When the positive pulse is applied to the base, Q1 conducts and shorts out the T-voltage on the bias bus. As the pulse decays, the base returns to zero voltage, thus applying the turn-on bias to the final amplifier drivers. This decay softens the keying on CW.

One set of contacts on RY3 grounds the output of the loop preamp on transmit. Since RY3 is in series with RY2, the transmit delay pulse will be completed and the transmitter will be turned on before the amplifier can be grounded. An oscilloscope across the preamp FET source resistor shows a rounded-front switching transient with a fast fall time. This transient is following the transmitter soft keying characteristic followed by a sharp cut-off as the RY3 contacts ground the preamp output. As explained previously, the back-to-back diodes are shunted across the preamp output to suppress this switching transient to a level that will not damage the FET.

CW operation requires further consideration of system functions. RY1 and RY2 are fast-acting relays that can follow high-speed keying. RY2, however, has an adjustable drop-out delay feature to allow proper relay sequencing of external equipment being controlled. The drop-out can be adjusted to keep RY3 actuated during CW keying. In this mode, RY3 will have no effect on keying. The transceiver also can be operated QSK in which mode RY3 can be kept actuated (by the switch in the control box) to use the same antenna for receiving and transmitting. QSK operation with a separate receiving antenna will be limited in keying speed.

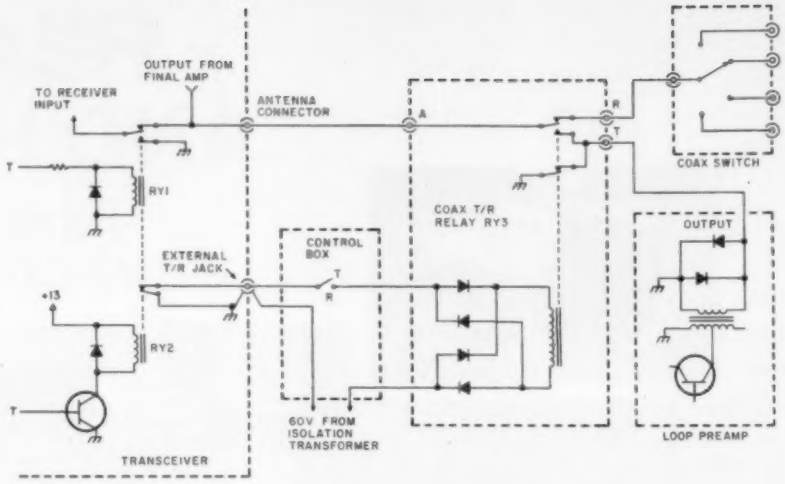

Fig. 7. Fail-safe control circuit.

RY3 is not intended as a high-speed keying relay. The 8-ms system keying delay, the 2.2-ms minimum RY2 drop-out delay, and the drop-out time of RY3 will limit keying speed to less than 13 wpm (estimated). This feature has not been tested. The system can, of course, accommodate high-speed semi-break-in operation.

The control circuit shown in Fig. 6 has the weakness of not being fail-safe. That is, if the voltage to RY3 fails, the transceiver will transmit directly into the output of the loop preamp. To make the circuit fail-safe would require transceiver T-R contacts to be normally-closed. A fail-safe control circuit is shown in Fig. 7. The switch in the control box is connected in series with RY3. The grounding contacts in RY3 should be connected to the T contacts instead of the R contacts as they are in Fig. 6. The relay terminals marked R and T on the relay case are interchanged from the circuit in Fig. 6.

Performance

I have had the opportunity to compare a full-length 160-meter sloping dipole (by extending about 2/3 of it into an adjacent unused property) to the inverted-L and the loop/preamp. The loop was tried in several locations around the yard with the bottom of the square always two feet above the base, including a ground-level, reinforced-concrete slab and a reinforced-concrete slab porch ten feet above the ground. No difference in performance could be detected at any of the locations except possibly some interaction from the inverted-L when the loop was a few feet from the downlead.

At any given time, different signals would be stronger from any one of the three antennas. The dipole seemed to favor signals from closer stations out to about 250 miles. More distant stations, particularly around 800 miles out, were favored by the inverted-L. The loop preamp, however, delivered stronger signals from more stations more of the time at all distances. Numerous weaker stations were increased to a solid-copy level when smothered in noise on the other two antennas.

The station location is in the high field of broadcast stations about one mile away on 1500 and 1540 kHz resulting in a host of spurious heterodyne and splatter signals. The loop appears to be less susceptible to this interference than either of the other two antennas. In some cases, the loop brought a signal right out of a heterodyne or splatter on either of the other two antennas.

The loop, however is particularly susceptible to TV receiver horizontal-sweep harmonics, a real disadvantage. In one respect, the loop did not perform as expected. It did not exhibit deep nulls in the plane of the loop. Also, nulls on all ground-wave signals and noise were always in the same direction, possibly because of distortion due to the close inverted-L and two houses.

The end result is a station with convenient operation of a separate receiving antenna and a 160-meter antenna system that is better balanced between transmit and receive performance. More stations are at a comfortable copy level, and more stations can be pulled out of the noise and made readable. The improvement is not worth-shaking, but a 6- to 10-db improvement in receiving capability has been achieved. ■

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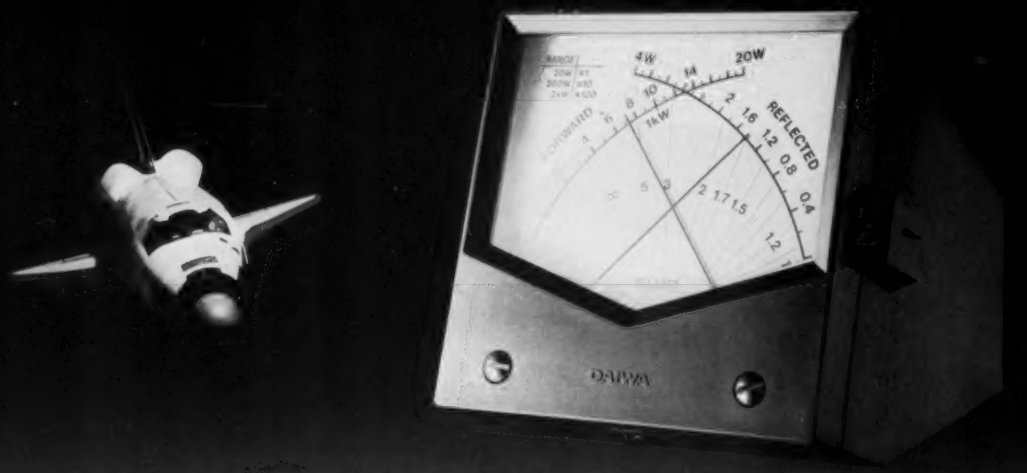

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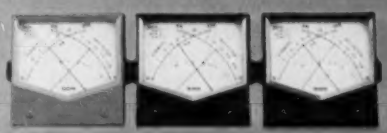

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The Fun-Amp

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The Fun-Mitter transmitter, described in *73 Magazine* (February, 1981), has provided an easy, affordable, and fun way to explore home brew and QRP. Some amateurs have expressed an interest in an amplifier that would boost the output of the 5-Watt Fun-Mitter. The Fun-Amp described in this article will do just that. The Fun-Amp is a CW amplifier that will provide about 20 Watts of output power. It also is based on the same criteria as for the other Fun gear, to make for a simple, inexpensive way to quadruple the Fun-Mitter power.

The Fun-Mitter, Funceiver, Fun-Oscillator, and now the Fun-Amp have all been designed with the casual home brewer in mind. The objective for this entire series has been to provide designs for gear that can be duplicated easily by all amateurs. All parts are available at Radio Shack outlets and each piece of gear is designed for a "no-tuning-adjustment" approach.

The Fun-Amp fits in quite nicely with this approach. In fact, it is probably the simplest and easiest to build of all of the items described so far. Total parts count in the Fun-Amp is under twenty, which includes the bypass capacitors.

The objectives for the Fun-Amp are basically the same as for the other Fun gear:

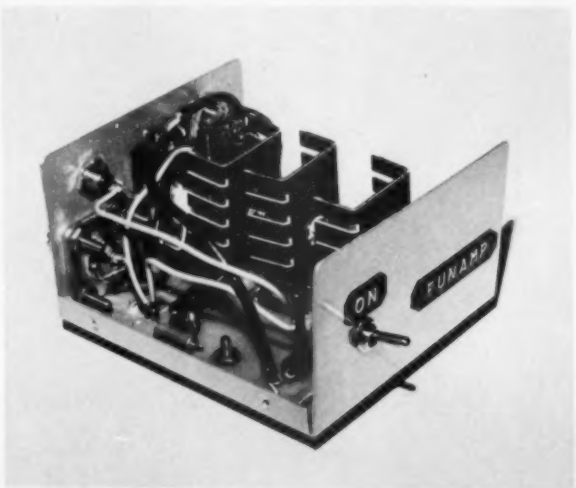
- Approximately 20 Watts output.
- No modifications to the Fun-Mitter.
- Same size PC board; same size case as for the other Fun projects.
- No tuning adjustments.
- All parts available from Radio Shack.
- Cost less than $25.

The objectives not only were met, but as the design evolved into its final form, the Fun-Amp became the best example of the philosophy behind this series.

Circuit

One of the exciting parts of this project is the use of the latest state-of-the-art technology. The active devices Q1-Q3 are VMOS FETs (Vertical Metal Oxide Semiconductor Field Effect Transistors). These devices have been available for several years but are just recently being used in amateur gear. I found it exciting to design and experiment with these devices and to discover that they truly do live up to their textbook billing. They also are very rugged, something that is a definite asset for home construction.

The advantages of VMOS FETS are numerous. Of utmost importance to this design is the lack of thermal runaway and the freedom from "mismatch" burnout. Thermal runaway is the condition that exists in regular transistors when the collector current increases the heat of the transistor, which causes more current flow, which causes



more heat, which causes more current. Eventually, the transistor can self-destruct. VMOS FETS have just the opposite effect—more heat tends to decrease current flow.

Mismatch burnout occurs in regular transistors when an impedance mismatch occurs between the load (antenna) and the output network. This is seen when a high swr exists—such as with an open line or non-resonant antenna. This condition can destroy most transistors quickly, but the VMOS FET comes through with flying colors.

Additional benefits of the VMOS FET are the ease of parallel use and ease of matching input and output. In order to reach the 20-Watt output level with Radio Shack parts, it was necessary to parallel three VN67AF VMOS FETs. No current hogging exists with VMOS, so no "ballasting" resistors were needed.

One problem of the VN67AF VMOS is the built-in static protection zener diode. This diode limits the maximum gate-to-source voltage which in turn limits the output power. Unfortunately, Radio Shack sells only the VN67AF. VMOS devices are manufactured without the zener diode, but in order to meet the objective of Radio Shack part usage, they were not used.

Fig. 1 shows the simple schematic of the Fun-Amp. I decided to use as simple a design as possible and thus eliminated an input network and an intricate output transformer. A good design goal for home-built equipment is "make it as simple as possible." The amplifier, however, does not suffer in performance due to the simplicity.

The input from the Fun-Mitter is applied to a "pi-type" attenuator (R1, R2, R3). This reduces the input power to the VMOS FETs to the needed level. The Fun-Amp can be driven with only 2 Watts, if desired, to reach the 20-Watt output level. This will be described in detail later. Three VN67AF VMOS FETs are used in parallel to generate the 20 Watts of rf power. Each FET supplies about 1/3 of the total power.

Because of the VMOS's built-in zener diode, CR1 has been added to the circuit. It clips the input sine-wave signal so that it does not go negative. If CR1 was not in the circuit, the FET would quickly be destroyed.

There is no forward bias used on the FETs and thus the amplifier operates in Class C. This is significant for two reasons. One, the amplifier can be used only for CW operation. SSB operation will result in severe distortion. Secondly, Class C operation results in high efficiency (power in/power out), which is a definite plus.

The output network consists of L2, L3, and C3. This network is commonly referred to as a T-network and its function is to match the output impedance of Q1-Q3(16Ω) to the 50Ω antenna load. It also offers some harmonic attenuation. L2 and L3 are constructed from Radio Shack 10-μH rf chokes—a technique familiar to builders of the earlier gear.

The amplifier is operated from +24 V, same as the Fun-Mitter. Current needed for the amplifier is around one Amp. The power supply described in the Fun-Mitter article should work fine, provided the regulator is mounted on a good heat sink, such as part number 276-1361. Total demand from the supply if both the Fun-Mitter and Fun-Amp

Parts List

C1	570 pF (470 and 100 in parallel)	272-125 272-123
C2,C5	0.1 uF	272-135
C3	80m: 1000 pF	272-126
	40m: 470 pF	272-125
C4	.01 uF	272-131
C6	10 uF, 35 V dc	272-1013
CR1	1N914 small signal silicon	276-1122
CR2	1-Amp, 50-V diode	276-1101
J1,J2	SO-239	278-201
J3,J4	Phono jack	274-346
K1	DPDT relay	275-206
L1	10-uH rf choke	273-101
L2	Modified 10-uH rf choke For 80 meters remove 14 turns For 40 meters remove 19 turns	273-101
L3	Modified 10-uH rf choke For 80 meters remove 10 turns For 40 meters remove 15 turns	
Q1-Q3	VN67AF VMOS power FET	276-2071
R1,R3	For 5-Watt Fun-Mitter use 150Ω,1/2 W	271-013
R2	For 5-Watt Fun-Mitter Use 33Ω,1/2 W	271-007
R4	47Ω, 1/2 Watt	271-009
R5	47k Ω,1/4 Watt	271-1342
R6	155Ω (three 470Ω, 1/2 W in parallel)	271-019
S1	SPDT switch	275-612
Misc.	TO-220 heat sink (3)	276-1363
	Heat sink grease	276-1372
	Case	270-251
	Hardware	64-3012 64-3019
	Wire	278-1304

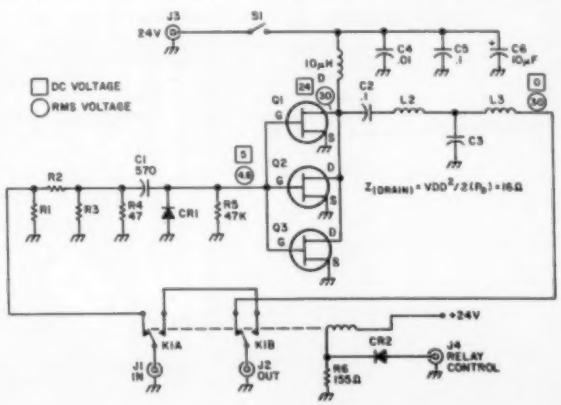


Fig. 1. Schematic.

are used will be less than 1.5 Amps, which is within the LM317 ratings. Because of CW operation, the actual average current will be around 3/4 Amp (50% duty cycle). Also, four lantern batteries can be used in series to provide +24 volts. Battery life will be reduced, however, due to the higher current levels of the Fun-Amp. Transmit/receive switching is accomplished by K1. This DPDT relay switches the Fun-Amp from receive to transmit when needed.

Construction

The Fun-Amp is built on the same size PC board as all earlier projects (2-1/4" by 3"). The PC layout is given in Fig. 2. Constructing the Fun-Amp should be very easy. However, as has been discovered by some hams building the earlier goof-proof projects, there is always a possibility for error. Basically, any problems that hams have encountered have been in one of three areas:

- Poor soldering (good solder practices are a must!).
- Faulty Radio Shack components.
- Non-use of PC boards.

In building the Fun-Amp, use a low-wattage soldering iron and rosin-core solder. Heat each PC pad and then apply the solder. A good connection will have a shiny appearance.

PC board use is recommended, particularly for first-time builders. Use the pattern given in Fig. 2. This will help avoid wiring errors. PC boards are available from me for $7 for those who are not inclined to build their own.

Because of the increase in power, a method is needed to dissipate the heat produced in Q1-Q3. Radio Shack heat sinks designed for a TO-220 transistor case are used for this purpose. Q1-Q3 are TO-202 devices, so a slight modification is needed. A new hole (approximately 1/8") needs to be drilled through the heat sink below the existing one. Use one of the FETs for a pattern, ensuring that the tab is flat on the heat-sink body. A #6 screw and nut can be used to mate the FET to the heat sink. Use a small amount of heat-sink grease (part number 276-1372) between the FET tab and the heat sink. These heat sinks work quite nicely even though they will become quite warm during CW operation.

To construct C1, connect one 470-pF and one 100-pF capacitor in parallel. Piggyback the two caps and solder the leads. Insert only one wire per leg into the PC-board hole.

To construct L2 and L3, use the same method as was used in all of the earlier projects. Remove the exact number of turns specified in the parts list, depending on whether your Fun-Amp is for 80 or 40 meters. These coils are less than optimum as inductors at the higher power level, but they work quite well and are particularly easy to reproduce.

Coax should be used for all rf connections to and from the relay and the PC board. Number 18 gauge (or similar) hookup wire can be used for the supply lead to and from J3 and S1.

The amplifier should be mounted in an enclosure. This provides rf shielding as well as protecting the PC board and relay from accidental shorting from outside devices. The Radio Shack cabinet mentioned in the parts lists is easy to work with and fits the PC board nicely.

As mentioned earlier, a relay-control voltage is needed to operate K1 which switches the amplifier in and out of the circuit. This voltage comes from the Fun-Mitter and is tapped off the +24 T-R voltage. If the Fun-Mitter was modified for use with the Fun-Ceiver, then merely run another wire from the jack to J4 of the Fun-Amp. If the Fun-Mitter has not yet been modified, it should be modified as shown in Fig. 3.

The key to goof-proof construction is to have all parts available at construction time and then to load and solder all parts carefully. This approach should yield a product that will work "first-time," a truly exciting moment in home brewing. The Fun-Amp construction, as mentioned earlier, should be completely goof-proof from loading to using!

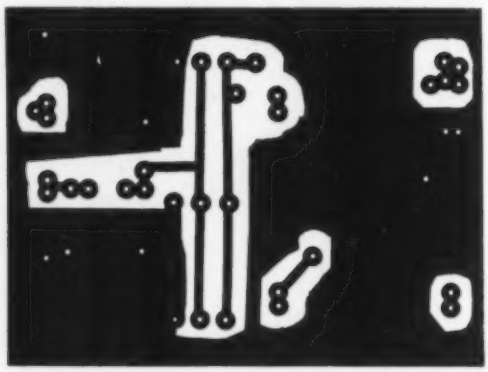


Fig. 2(a). PC board.

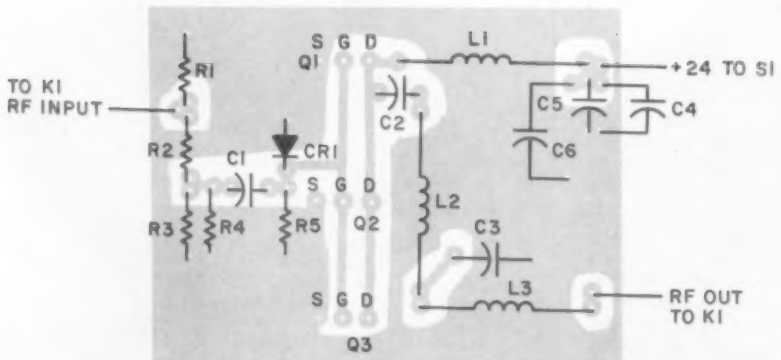


Fig. 2(b). Component layout (foil side view).

Operation

Turning on the Fun-Amp should be even easier than building. No tune-up adjustments are needed. Merely apply 24 V, a relay-control voltage, and an input signal—and an output signal should appear!

Before applying +24 V, however, it might be wise to check for shorts. Visually inspect the PC board for solder or etching shorts. If an ohmmeter is available, a reading of greater than about 100 to 200Ω should

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occur between ground and the drains of Q1-Q3 (with S1 off). This reading will vary depending on the model of ohmmeter you have and the polarity of the leads. However, if it is near zero Ohms, re-inspect the board and components for a short. If you don't have an ohmmeter available, feel at ease to merely visually inspect the board as that will reveal nearly all potential shorts.

If an ammeter is available, connect it in series in the +24 V line going to J3. With no drive applied to the Fun-Amp (and S1 on), there should be a small amount of current flowing (about 50 mA). This current is due to the relay current. Always use a 50Ω dummy load at J2 during tune-up.

Next, apply drive by keying the Fun-Mitter. (Don't forget to connect the relay control voltage to J4.) A reading of around one Amp should exist on the ammeter and about 20 Watts of rf should appear at J2 as seen on a wattmeter.

If desired, the Fun-Amp can be driven with less than the 5 Watts available from the Fun-Mitter. The attenuator circuit dissipates power, which creates an inefficient circuit. If the Fun-Mitter is run off only 18 V instead of 24 V, then there is less wasted power. About 2 Watts of power output will occur from the Fun-Mitter at 18 V. With two Watts of power input to the Fun-Amp, the values of R1, R2, and R3 should be changed to 330Ω, 15Ω, and 330Ω, respectively. This change will necessitate a change in dc supply voltage to the Fun-Mitter, however, which may be more of an inconvenience than the small amount of wasted power. It is mentioned for two reasons. First, if battery operation is used, going from 24 V to 18 V (for the Fun-Mitter) is very simple and the reduction in current helps prolong battery life. Second, this illustration should help those with other types of transmitters to envision ways to drive the Fun-Amp.

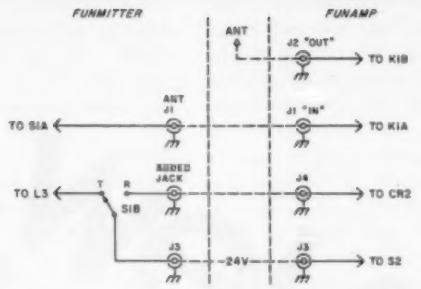

Fig. 3. Connections between Fun-Mitter and Fun-Amp.

Conclusion

The Fun-Amp should help increase the signal strength of the Fun-Mitter when conditions warrant. It should also be an enjoyable way to construct a useful piece of home-brew gear.

I would be very interested in hearing from hams who have constructed any of the Fun gear, for your suggestions and to learn of you experiences. ■

Acknowledgements

I would like to thank the many hams who have responded to earlier articles in this series for their suggestions and for their interest.

Special thanks go to Sam Babb for his design suggestions on the Fun-Amp.

Also, I would like to thank my wife, Dottie, for her enthusiastic encouragement and excellent typing skills. She makes writing these articles possible.

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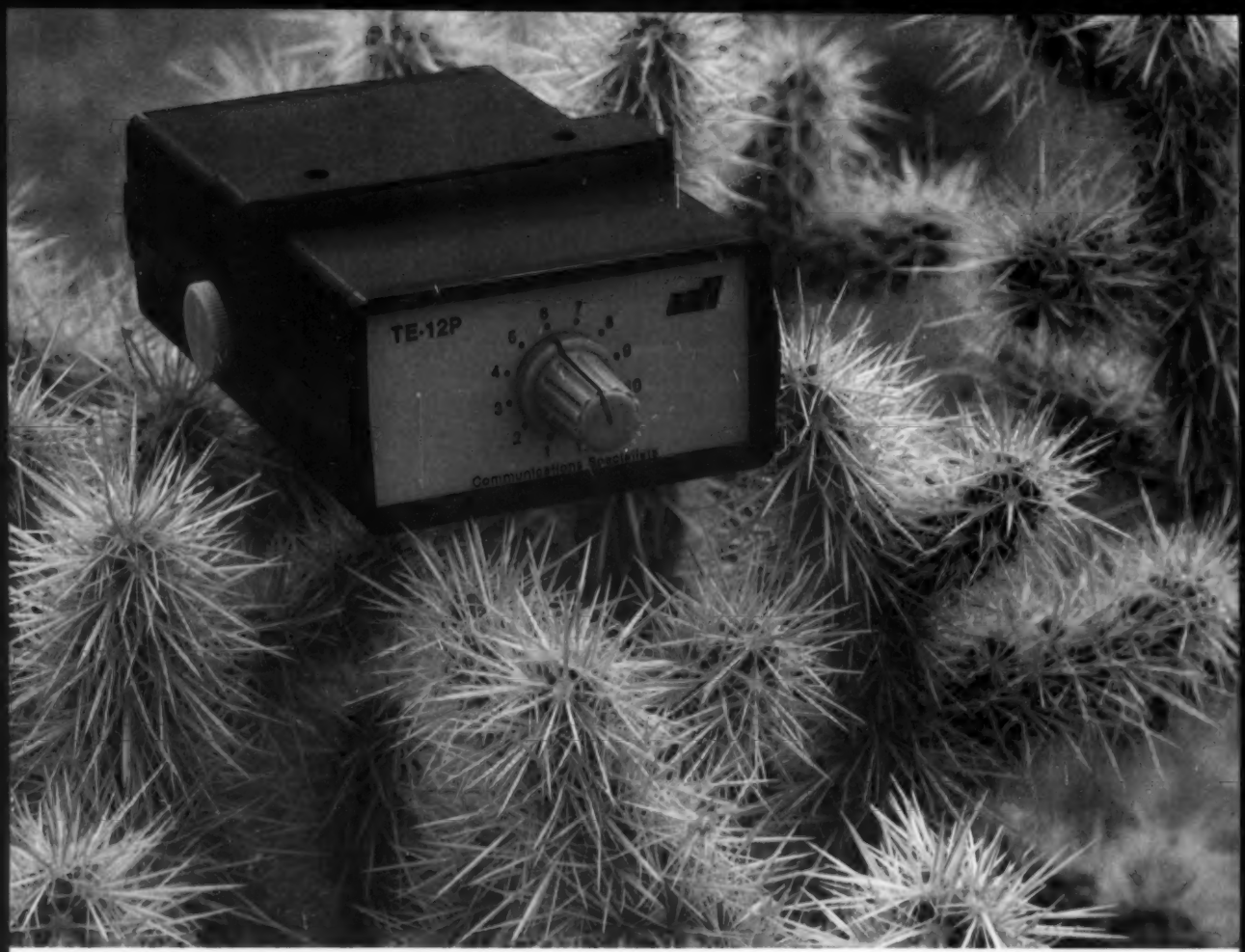

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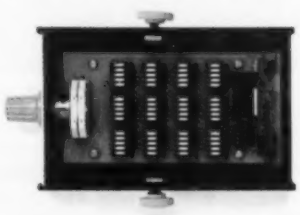

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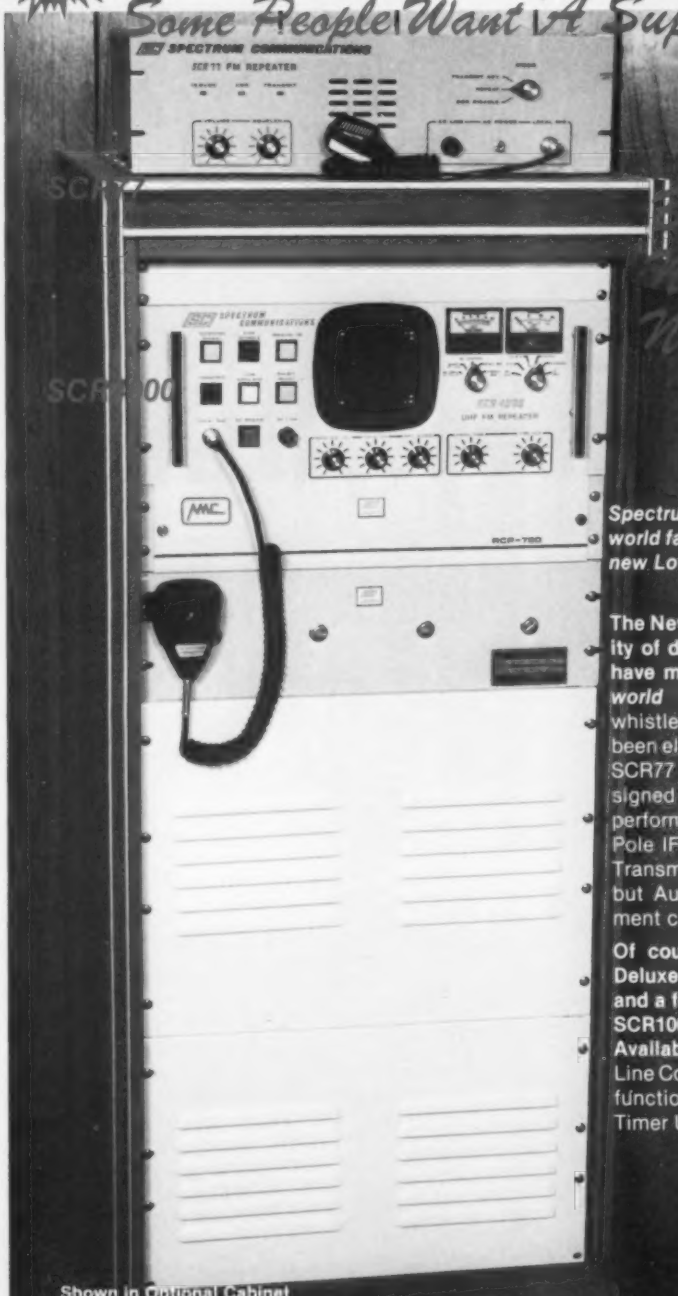

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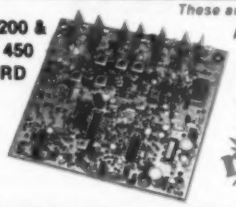

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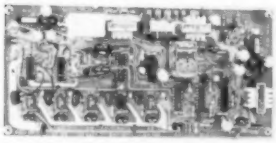

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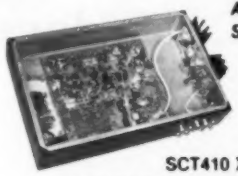

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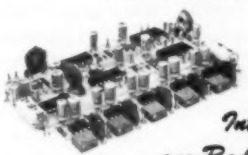

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The CCD Antenna Revisited

— does it measure up on 40m?

The articles which appeared in *73 Magazine*[1,2] describing the concept of the CCD antenna really hit a high spot with me. After all these years of experimenting with and building dipoles and beams, the CCD antenna certainly presented a fresh and exciting project. W4ATE and W4FD deserve a pat on the back for exploring the applications of this concept for amateur use.

My objective in building this antenna was to see if the concept put forth by W4FD, W4ATE, and others who had built this antenna really measured up to the specifications. This antenna performs better than any single wire antenna I have ever built in the past.

I decided on using center feed for this antenna simply because it suited my real-estate layout. The feedline was a good grade of 300-Ohm TV line. Prior to installing the feedline, I applied a heavy coating of floor wax over the entire length of the line. This paid off, especially during wet weather; the impedance of the antenna system remained quite stable. I also tried a 4:1 balun fed with 50-Ohm coaxial cable. At the resonant frequency of the antenna, the swr was 1.6:1, and at the extreme high frequency end of 40 meters, the swr was 2.5:1.

I cannot quote specific figures of gain, radiation patterns, or angles of radiation for this antenna because I do not have the necessary test equipment nor an antenna range to perform such tasks. However, I can state that I am hearing more stations and have had many more solid QSOs than I've ever had with my inverted V antenna. One thing in particular that I have noticed is that this antenna is much quieter than any other antenna I have used. It's much easier to hear and work weak stations. Don't let the length of the 40-meter antenna deter you from trying it; the amazing thing is that you can zigzag this antenna in just about any plane, including through trees. Another thing that I've noticed is that when I contact another station that is using a CCD antenna, there seems to be much less QSB on the signals. I have used this antenna on 15 and 20 meters with excellent results. I have no interest in 10 meters, but I'm certain that it will perform well on that band. The other night I had to get on 75 meters to meet a sked, and for the fun of it I tuned up using the antenna matching network. I was able to put out a respectable signal for local work.

It didn't take me long to gather up the parts for this antenna. I had to make the insulators, and for the wire I used the secondary of an old power transformer, which was number 22 wire. It was easy to handle and didn't cost a cent.

Basically, I wanted to build this antenna in such a manner that I could experiment with it and make changes if needed. This approach resulted in the following mechanical configuration. I used 140 feet of thin nylon cord with a tensile strength of 350 pounds. This cord was used as a messenger from which the an-

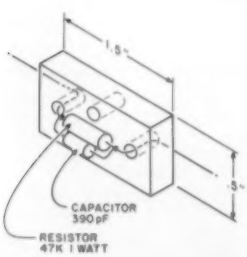

Fig. 1. Insulator with mounted resistor and capacitor.

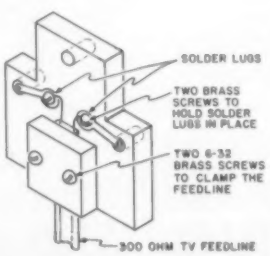

Fig. 2. Feedpoint insulator with feeder clamp in place.

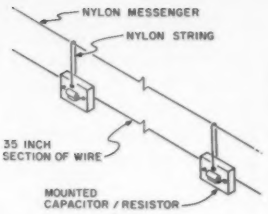

Fig. 3. Nylon messenger and 1 section of antenna.

tenna was suspended. Initially, I hung the messenger 3½ feet above the ground.

Next, I made a jig on a piece of wood which had two nails separated exactly 35 inches. Then I bent 48 pieces of wire around the nails, leaving a 2-inch tail at each end. The tails are used to tie in the resistor/condenser combination. When you've finished cutting and bending the 48 pieces of wire, put them aside in a neat arrangement so they won't snarl.

I used 46 one-Watt resistors, with a value of 47k, and 46 Mallory SXM 339 capacitors, 390 pF, at 160 volts dc. Prior to installing these capacitors, I found that 2 were defective, and 1 was not within tolerance. The testing of the capacitors prior to installation can save you a lot of problems and work later on.

The next job was to make 48 insulators and the feedpoint insulator. I used some 1/8-inch Lucite that I had in the junk box. Figs. 1 and 2 give the details. The next step involved mounting and soldering a capacitor and resistor to each section of wire. Remember, you have 48 sections of wire and only 46 capacitor/resistor combinations. Start at the feedpoint insulator and connect the first section of wire (the end without the insulator) to the feedpoint insulator solder lug and solder it.

The other end of the wire will have the capacitor/resistor mounted on an insulator. Refer to Fig. 1 and note the hole at the top middle of the insulator. I used a 7-inch piece of nylon string and suspended the insulator about 3 inches below the messenger. I continued this process until all the sections were installed and soldered. Using this method of suspending the wire sections allows the antenna to ride free, with no mechanical strain on it whatsoever. So far the antenna has withstood 45-mph winds, rain, and hot sun without any problems. Fig. 3 shows a section of the completed antenna.

The mechanical work is now completed, and we're ready to begin the preliminary antenna tests. I used the authors' design criteria[1] for a 40-meter antenna with a low frequency cutoff of 7050 kHz. I connected a 3-turn loop at the feedpoint insulator and, using a grid-dip meter, resonance occurred at 7002 kHz. Next, the 300-Ohm TV feedline was connected to the feedpoint. About 80 feet of line was needed to reach the shack. I prefer the use of an antenna tuner rather than a 4:1 step-up transformer, because a tuner permits you to tune out any residual reactance in the overall antenna system. Next, I tuned up the transceiver on 7200 kHz and adjusted the antenna tuner for minimum swr between the exciter and the input of the antenna tuner. Using a Bird wattmeter, I set the output of the exciter to 1 Watt. Any swr meter will serve the same purpose; the main consideration here is that only a minimum of power is required to excite the antenna. The rf indicator which I used to check each section of the antenna consisted of a 50 μA meter, using a couple of 1N34s as rectifiers. A 6-inch piece of wire was used as the rf probe. Next, I walked the entire length of the antenna, holding the rf probe at a uniform distance from the antenna, and checked each section. At the ends of each section, I recorded 12 μA, and near the middle of each section, the rf probe indicated 29 μA. These same approximate readings occurred at each section, right down to each end. In other words, I had a uniform radiating surface over the entire length of the antenna. Remember, this antenna is only 3½ feet above ground. It didn't take me long to get back into the shack and fire up on 40 meters.

The first thing that I noticed was that the receiver was very quiet. Signals were right up there in strength. I made three contacts (about 200 miles) and my reports were Q5 and S9 plus. This was with 100 W dc input. I left the antenna at 3½ feet for about a month and did a lot of listening and QSOing. The results have been more than gratifying.

My next task was to raise the antenna to 50 feet. This was a snap with the nylon messenger. All I had to do was coil the antenna up, take it to the mast, stretch it out, attach the feedpoint insulator to the halyard, and pull it up. Next the ends of each messenger were snaked through and among the trees and secured wherever convenient. I find it difficult to describe the physical configuration of the antenna, but the feedpoint is up about 50 feet and the rest of the antenna is hidden among the trees. I have 86 trees on the property and an XYL who loves trees; 'nuff said.

All in all, I'm very happy with the results of this antenna and I'm thankful to W4FD and W4ATE for providing me with a very interesting and rewarding project. ■

References

1. Harry A. Mills, Gene Brizendine, "Antenna Design: Something New," *73 Magazine*, October, 1978.
2. Harry A. Mills, Gene Brizendine, "The CCD Antenna—Another Look," *73 Magazine*, July 1981.

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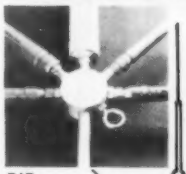

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Antenna-Raising: The Good-Neighbor Policy

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While working as a public relations representative for one of the top five U.S. oil companies, I have learned, among other things, that the truth isn't nearly as important as what the public perceives the truth to be. I knew the instant I put up my very first beam ever, over my new suburban Houston home, that my neighbors were not going to know what it was and what they perceived it to be could cause me a lot of trouble.

My concern for ensuring good relations with my neighbors might have been prompted by paranoia from continuously explaining oil-company profits and prices, but more than likely it was the fact that my house sat only ten feet away from my neighbors on each side. I lived right in the middle of my subdivision, where the standard lot size was 50′ × 100′. Wherever the concern came from, it caused me to plan a little public relations into the installation of my beam. If you're planning to install a beam and/or tower for the first time, you might want to include some public relations, too, especially if you live close to your neighbors.

View of my house with antenna on top as seen from across the street. This also shows my next-door neighbor washing his Corvette. He never said a word about the antenna, but he did want to know about ham radio.

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I didn't want to confront problems with my neighbors after I put up my beam, so I set out to educate them about what was going to be on top of my house. Not that I thought that fact alone would persuade them to let me live in peace on 20-meter CW, but I felt sure that if these folks saw an antenna on top of my house without knowing exactly what it was, they were sure to think that I was a CBer running 5000 Watts into stereos, televisions, telephones, and intercoms. Thus, they would try to have my antenna taken down the minute they saw it.

My first action was to make sure that my installation was going to be legal. Like many high-density subdivisions in metropolitan areas, my subdivision had a homeowners association with a list of strict deed restrictions. Living ten feet apart we needed them! Antennae were covered in paragraph 17: "Maximum Height of Antennae: No radio or television aerial wires or antennae shall be maintained on any portion of any residential lot forward of the front building line of said lot; nor shall any free-standing antennae of any style be permitted to extend more than ten feet above the roof of the main residential structure of said lot."

This wasn't news to me. It was the first thing I checked before buying the house. (For some reason my XYL kept looking at wallpaper.) I already had planned my installation to include a 4" × 4" post anchored to my attic floor, going through the roof at its point, and extending three feet above the roofline. I would attach a nine-foot piece of 2¼" galvanized pipe to the 4" × 4", with the bottom of the pipe flush with the roof.

With the rotor and beam on top of the pipe, the in-

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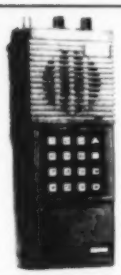

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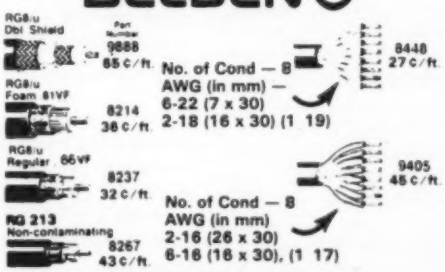

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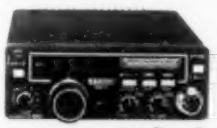

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stallation would be exactly ten feet above the roof. I had a two-story house with the point of the roof 25 feet above ground level, so the beam would rest nicely at 35 feet. Cushcraft recommended a minimum of 33 feet, a half-wave at 20 meters, for their ATB-34 tri-band beam.

My next action was to inform the chairman and members of the subdivision's architectural control committee of my plans. Though my installation was going to be legal, if my neighbors started calling these guys, it really could stir up a mess. I wanted to get to them first with facts instead of speculation. Instead of a personal visit to a committee meeting, I decided to write a letter. Here's what I said:

"I am writing to let you know about an antenna I am erecting on top of my house, and to assure you that it complies with the deed restrictions of our community.

"The antenna is an amateur radio beam antenna used for directing radio signals to a predetermined geographical area. Unlike a Citizens Band (CB) radio operator who is limited to 40 channels in one frequency band and five Watts input power, an amateur radio operator, or ham, is licensed to operate on a multitude of frequencies in several different frequency bands using 1000 Watts input power. Thus, it is as common for amateur radio operators to talk with hams in foreign countries as it is to hams in their own hometowns.

"I have been a ham for seven years and have talked with other hams in Europe, Africa, and Asia, including the Soviet Union. The antenna I am erecting will allow me to direct my signals using frequencies in three amateur bands. This antenna will also allow me to conduct emergency communications in our neighborhood should the need ever exist.

"Like most homeowners, I am concerned about the aesthetics of our community and adherence to the community's deed restrictions. In accordance with our deed restrictions, my antenna will not be ten feet higher than the highest point of my roof and it will not have any part forward of the front of my house. For your review, I have enclosed a drawing of how my installation will look. Would you please inform me about your acceptance of these plans. Respectfully,. . ."

I accomplished several objectives with this letter. I let the architectural control committee know that I was not a CBer, that I had expertise in my hobby, that I was concerned about making sure my installation adhered to our deed restrictions, and that I cared about neighborhood aesthetics. Plus, I asked that the board respond about acceptance of my planned installation.

About two weeks after I mailed the letter, I received a reply from the committee: *"Your planned installation of an amateur radio station antenna is in accordance with the deed restrictions of our community and we plan no action regarding it at this time."* There it was in black and white: ". . . is in accordance with the deed restrictions. . ." Believe me, that was a valuable document.

Now to get ready for the installation. I had the 4" × 4" post, 9' piece of pipe for the mast, rotor, and beam. I began working to place the post through the roof and run the coax and rotor cable. A few days away from installation, I wrote another letter, one I planned to give each of my neighbors who would be able to see my antenna from their homes.

I walked up and down the street in front of my house with an eye on my roof. I did the same from the street in front of my neighbors' houses behind mine. I figured there were 26 homes from which my neighbors would be able to see my beam from their yards. My plan was to give each of these neighbors a letter about the beam the day I put it up. Here's what it said: *"You have probably seen an antenna on top of my house at 7703 Hollow Glen Lane. I want to explain why it is there and assure you that it complies with the deed restrictions of our community."*

I then duplicated the second, third, and fourth paragraphs of the letter I sent to the committee. The letter ended this way: *"The chairman and members of the architectural control committee are aware of the installation of this antenna and have said that it is in compliance with the deed restrictions of our community. There are hundreds of thousands of amateur radio operators around the world, and communicating with them is truly an exciting hobby. If you, your friends, or children are ever interested in amateur radio, please let me know. I would be pleased for you to visit my shack for a demonstration. Respectfully,. . ."*

Finally, everything was ready. I took a day off from work to put up the beam since I didn't want to do it on a Saturday or Sunday with the neighbors staring at me. A friend came over to help me and up it went without a hitch. Inside the shack, on the second floor directly beneath the antenna, I tuned up, checked the swr, which was nearly one to one, and immediately began working 20-meter DX. It was early afternoon and I stopped long enough to deliver the letters. It is illegal to place such a letter inside someone's mailbox, so I attached the letters to the doors of the houses.

Then it was back to the shack. The efforts I made to put up the beam were justified, as I worked several new countries in a matter of an hour. My HW-101 was producing 599 signals from Europe, and as I began to turn the beam, my thoughts turned to the neighbors. I didn't know what to expect from them when they got in from work that afternoon and saw the addition to the neighborhood. Whatever happened, I felt good knowing that I had done a little PR in advance of their discovery.

I was kind of scared to go outside for a few days, but the weekend came and along with it yard work. I eased outside and started my Saturday-morning ritual of mowing and edging, along with several of the neighbors. Occasionally, I would look skyward to the beam and think, "My gosh, that's big!" Though there were quite a few folks in their yards who could have grouped to descend on me lynch-mob style, I received nothing more than the usual friendly waves. The weekend passed with twelve new countries on CW and no threats from the neighbors.

A week passed, a month, then several months. Nothing. Not a word. Had I done a good PR job or was there apathy in the community? It's the same question often asked in public relations when we plan for a potential problem but nothing happens. The fact is, I'll never know what might have happened, but I do know what did happen. I operated with my beam for two years before being transferred, working DXCC-CW with about 100 Watts output. I never got any flak over the antenna, but I did get lots of questions about ham radio. I just wonder how many of my neighbors' thoughts changed from aesthetics to my signals around the world as they looked skyward to my beam. ■

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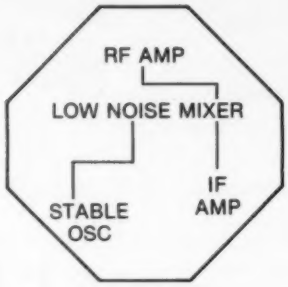

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'Lite Receiver IV

—part I: building it is a breeze

This is the first installment of a two-part article on a complete, simple, home-brew satellite TV receiver. If you have been following our satellite TV articles in *73*, you know that it is possible to build a home-brew LNA. And, with our simple downconverter, you have all of the hard parts of your home satellite TV system complete!

The LNA was described in the February, 1982, issue of *73*, and the downconverter was described in the March, 1982, issue. With these two additional articles, you can easily build a complete, reasonably-priced satellite TV receiver capable of outperforming commercial units costing several times as much.

And, with the LNA and downconverter complete, you are down to a reasonable frequency with which to work, the 70-MHz intermediate frequency. If you are tired of dealing with gigahertz, then the remainder of the receiver will be a breeze!

Refer to the block diagram, Fig. 1. As we previously mentioned, the LNA and downconverter were covered in previous articles. In this installment of the receiver article, we will describe the bandpass filter/i-f amplifier board and the "heart" of the receiver, the video demodulator board. Part II of the 'Lite Receiver IV article will describe the dual audio board and the afc/meter board. The block diagram also shows the interconnections between the various component parts of the system. The power supply board was described in the February LNA article.

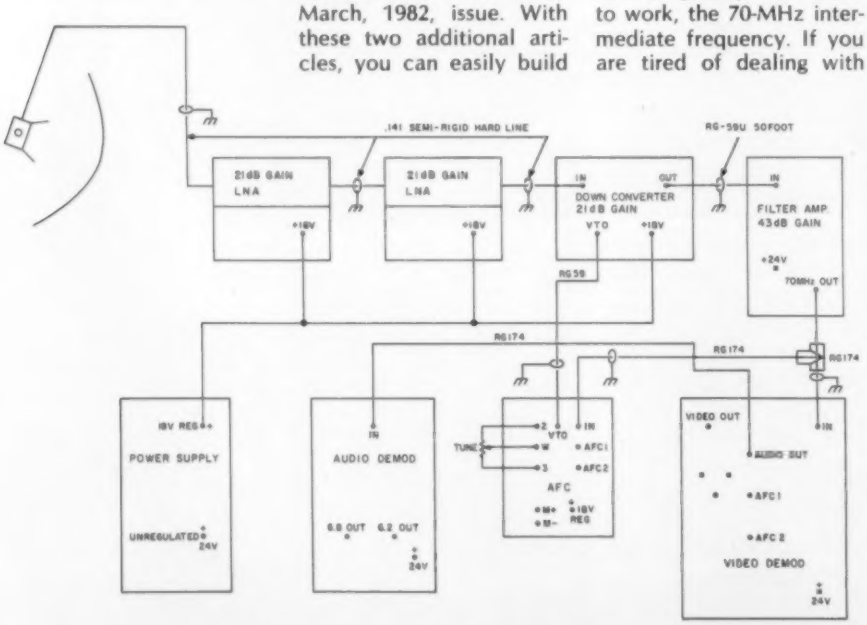
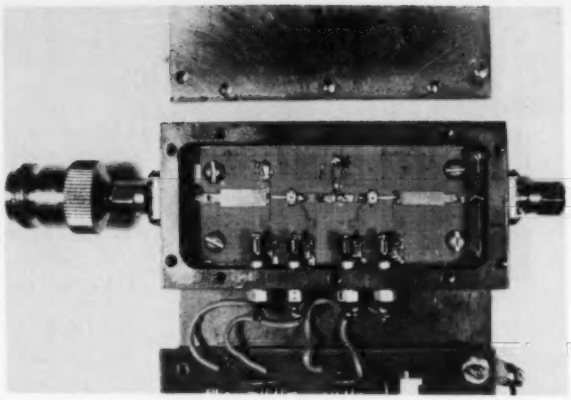


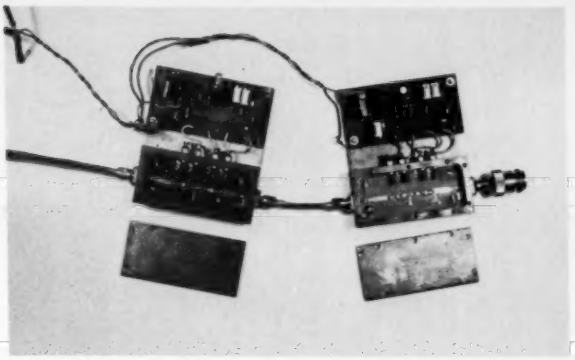
Fig. 1. Block diagram showing interconnections.

Circuit Development

We started on our home-brew system well over a year ago. It took us about seven months to actually get a picture from the bird(s), and we have spent the last six months optimizing our design, simplifying it so that we feel that any



One stage of the low noise amplifier (LNA) described in "Job's Own LNA," 73 Magazine, February, 1982.



Complete LNA with bias power supplies.

average technician can easily duplicate our system. You don't have to be a microwave engineer to make it work.

To develop the complete satellite TV receiving system, we used 15 square feet of printed circuit board, 18 pounds of ammonium persulfate etchant for the board, 5 pieces of 10" × 20" photo reversing film making negatives for boards, 48 pounds of coffee, and 32 cartons of cigarettes. We designed, built, and debugged approximately 40 individual printed circuit boards trying various circuits.

We will describe as we go some of the things we tried that either didn't work or didn't meet our expectations. During our development, we were extremely fortunate to have a professional video technician, Alex Guarino WA4OCG, to critique our received signal video and offer suggestions on improving it. Alex now favorably compares our received video with the commercial cable TV installations with which he is familiar.

We had never seen a satellite TV installation before we got our homebrew system working and, during the development of our system, we did not have access to any test equipment that functions on the satellite TV frequencies. The only test equipment used to debug the system was an old Heathkit Tunnel Dipper (grid-dip meter), a sweep generator, a marker generator, and a 5-MHz Heathkit oscilloscope. So, if we can make a receiver work with our very limited test equipment, we feel that any average technician, using our proven PC board designs, can easily duplicate our system.

The "IV" in the 'Lite Receiver IV* signifies that it is the fourth generation receiver that we have built. The last two were built from the exact PC boards which are in these articles, and they worked the first time power was applied!

*"Lite Receiver IV is a trademark of Martcomm, Inc.

70-MHz Bandpass Filter and I-f Amplifier

Just like your ham band receiver, the signal from the mixer contains many signals and noise. Therefore, the first step after the mixer is to clean up the signal and eliminate all frequencies we don't need. The output of the mixer is a low-level signal of approximately −50 dBm. Refer to Fig. 2, the filter/amplifier schematic. This low-level signal is applied to IC A-1, a Motorola MWA-120 broadband amplifier with 14 dB of gain.

70-MHz Bandpass Filter/i-f Amplifier
Parts List

1 2-1/4" × 4" × 2-1/2" minibox, Bud CU-3003A
1 PC board, double-sided (Martcomm, Inc., Box 74, Mobile AL 36601)
3 MWA-120 ICs
1 7815 voltage regulator
2 1-uF tantalum capacitors, 35 volts
3 470-Ohm, ½-Watt resistors
2 2200-Ohm, ¼-Watt resistors
1 470-Ohm, ¼-Watt resistor
1 51-Ohm or 47-Ohm ¼-Watt resistor
2 .01-uF disc ceramic capacitors
2 J. W. Miller coils, L1 and L4, 49A678MPC, .60-.074 uH
1 J. W. Miller coil, L5, 49A347MPC, .250-.415 uH
2 J. W. Miller coils, L2 and L3, 49A537MPC, .393-.657 uH

Total cost is approximately $60.00.

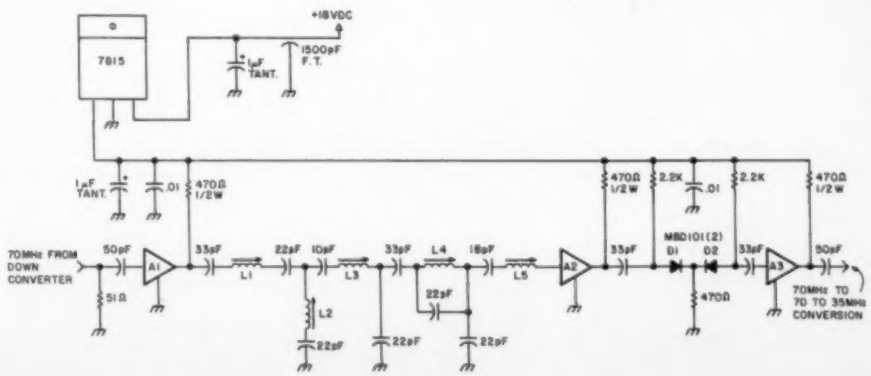
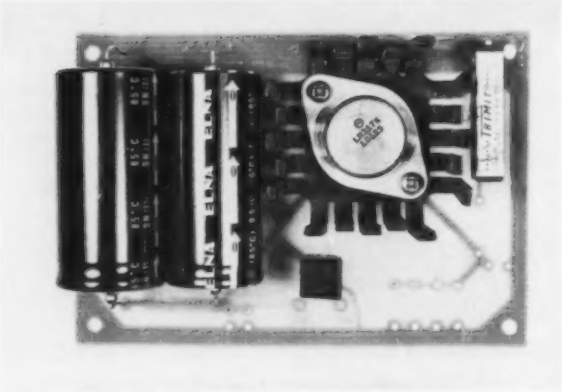


Fig. 2. 70-MHz filter/amplifier schematic.



Power supply for the entire receiver. It was described with "Job's Own LNA," 73 Magazine, February, 1982.

The output of IC A1 is fed to the 70-MHz bandpass filter consisting of coils L1 to L5 and their associated capacitors. The bandpass filter has a center frequency of 70 MHz and a 30-MHz bandwidth at the −3 dB points. The output of the filter is applied to IC A2, another MWA-120, for additional gain, and then through hot-carrier diodes D1 and D2 for some limiting. The output of the diodes feeds another MWA-120, A3, for another 14 dB of gain. The total gain of the 70-MHz stages, less the filter insertion loss, is approximately 43 dB.

A PC board for the filter/amplifier and a parts overlay are shown in Fig. 3 and Fig. 4, respectively.

A phase-locked loop (PLL) was chosen for the video detector since it can demodulate very low signal levels. But the PLL is prone to overload, so one stage of limiting using hot-carrier diodes was needed to smooth the signal level. Limiting is necessary because signal levels vary from transponder to transponder.

Printed Circuit Board

The PC board was designed to accept readily-available components. We found that the J. W. Miller pre-wound PC coils, although relatively expensive, are simple to work with and the filter can be duplicated more easily with known inductance values. The entire assembly fits in a 4"x 2-1/4" × 2-1/2" minibox with the input and output coax connectors being either BNC or type F. The +18 volts dc required for the MWA-120s is brought into the minibox through a 1500-pF feedthrough capacitor which is bolted to the minibox. The 1500-pF value is not critical, and you can substitute any reasonably close value. A word of caution about the Motorola MWA-120s. Buy them only from prime sources. We have had bad luck with the 120s, with about one out of three being bad. So, buy a couple of extras, just in case.

Construction

Construction is very simple if you use the double-sided printed circuit board layout shown in Fig. 3. A parts overlay is shown in Fig. 4.

First, mount the MWA-120s on the component side of the PC board. Be sure that they lie against the copper backplane and that the pins are in the correct holes. Solder the IC tab to the backplane. Then solder and clip the excess leads on the bottom of the board. Install the 3 feedthrough jumper wires very close to the ground pin of the MWA-120s. You can use a piece of resistor lead for the feedthrough jumper wires. Be sure to solder the jumper wires on both the bottom and top of the board.

Now install and solder the remaining components on the board. Some of the components are a tight fit due to the very compact size of the assembly. After the PC board assembly is complete, check to be sure that all components are in their proper place and that there are no solder bridges.

Next, drill the 3 holes in the minibox for the coax connectors and the feedthrough capacitor. Also drill the 4 holes for the PC board standoffs, which can be either regular standoffs or long 6-32 screws. Since the Bud minibox is 2-1/4" high and this height is not needed, we cut ours down to 1-1/2" high. When the box has been prepared, install the 1" standoff spacers. Use cutoff resistor

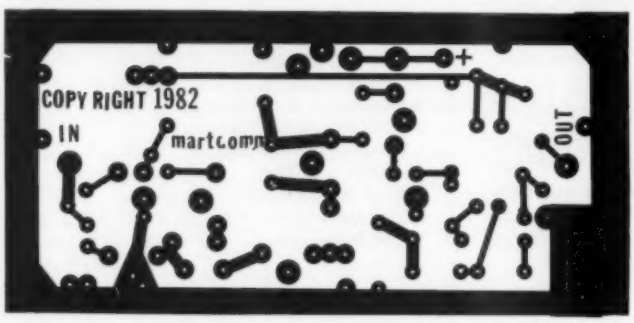


Fig. 3. PC board for the filter/amplifier.

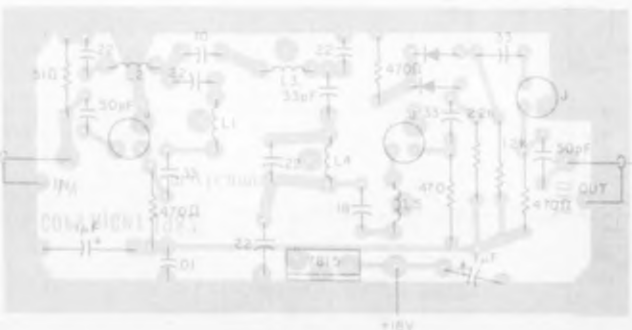


Fig. 4. Component layout for the filter/amplifier board.

Reader Service for facing page 72

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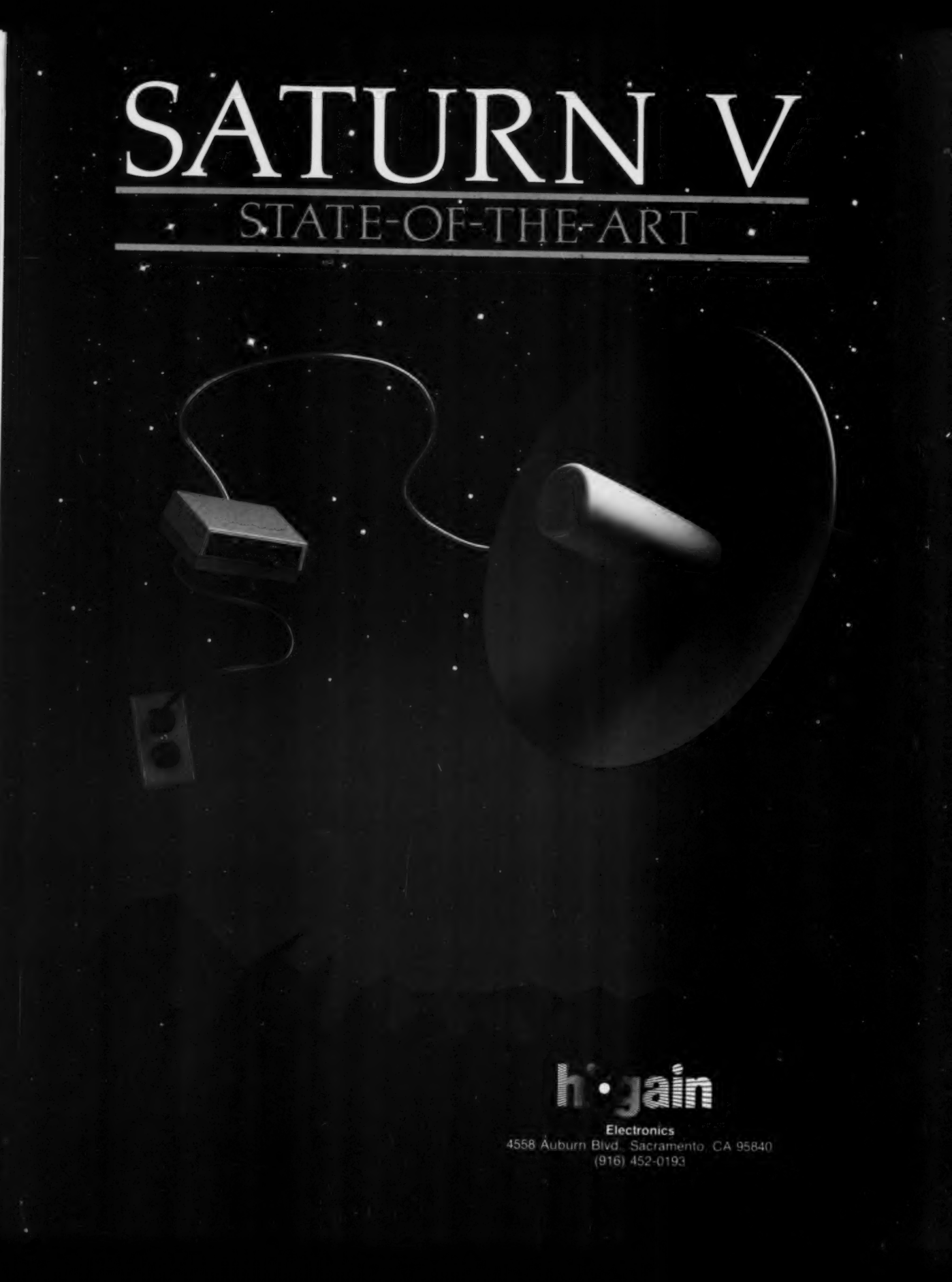

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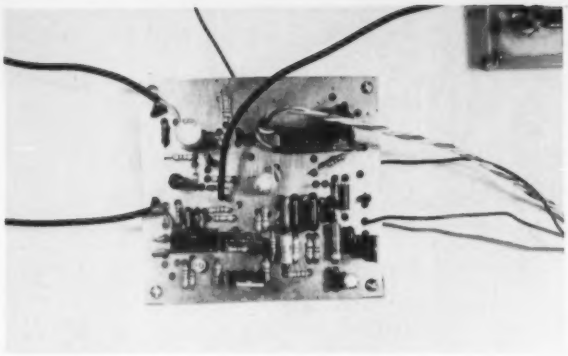
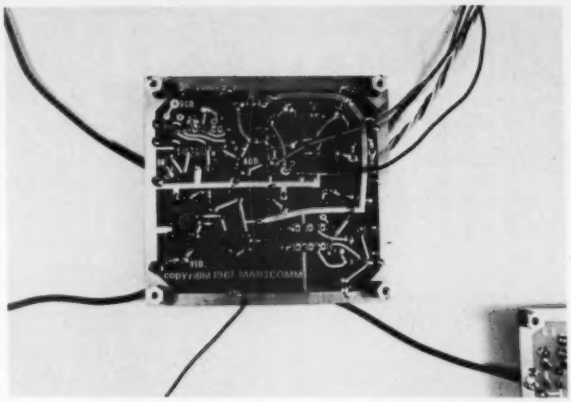


Top view of the video demodulator board.



Bottom view of the video demodulator board.

leads or small pieces of bare wire to connect the center conductor of the coax connectors to the PC board. Use the same technique to connect the +18 volts dc from the feedthrough capacitor to the board. Note that the board is installed in the minibox with the trace side toward the top of the box. There are holes in the PC board to allow access to the filter coils from the bottom of the board. This completes the construction of the board. Now comes the fun part, aligning the filter.

Tune-Up

The filter alignment is not nearly as difficult as everyone would have you believe. You can tune it in one of two ways: 1) with a sweepmarker generator and oscilloscope with a demodulator probe, or 2) with the receiver tuning meter (which is incorporated on the afc/meter board). We don't recommend using the tuning meter approach; the result was as good as using the sweep generator, but you have to have a lot of patience to do it that way.

To align the filter using the sweep generator and marker generator, connect the output of the sweep generator to the input of the filter (marked "IN" on the PC board). Connect the scope's demodulator probe to the output (marked "OUT" on the PC board). See Fig. 5. Preset all coil slugs to mid-position in the coil forms. Apply power (+18 to +23 volts dc) and, with a voltmeter, check the output of the voltage regulator. It should be +15 volts. Next check the voltage from ground to each MWA-120/470-Ohm, ½-Watt resistor junction. The voltage should be approximately +5 volts at each of the three points. If your wiring is OK and the voltage is wrong, then you probably have a bad MWA-120. If this is the case, replace it.

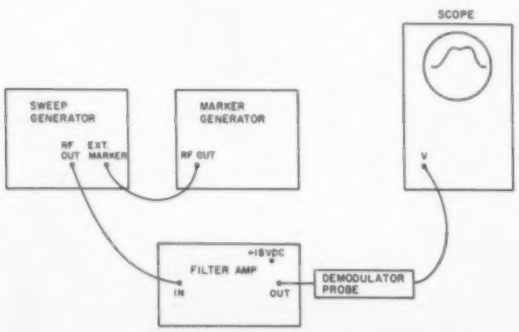


Fig. 5. Alignment setup for the filter/amplifier.

Start with as low an rf level from the sweep generator as can be seen on the oscilloscope. Reduce the rf level as alignment proceeds. See Fig. 6 for the desired bandpass shape. If the sweep is set too wide on the sweep generator, a spike will appear on the left side of the scope trace at approximately 110 MHz. Don't worry; the spike is the second harmonic of the 55-MHz coil resonance. Patience and persistence will reward you with a properly aligned filter. Just remember to make small changes in inductance. For the record, it took us about a day to align the first filter we built from Radio Shack's 100 for $2.95 coil-form special. The filter built with the Miller coils took only 15 minutes to align!

Video Demodulator

Our first attempt at demodulation used the NE564. It worked for about 5 minutes before the IC got hot and quit working. We experimented extensively with the 564, ultimately arriving at a configuration which, although very simple, permits adjustment of the critical operating voltages. Our final configuration allows you to optimize for your particular NE564. But, being the experimenters that we are, we wanted to try more traditional ways of demodulating an FM signal.

We tried a bridge discriminator and the "classic" Travis discriminator. They worked, but believe us, aligning a traditional-type discriminator for a 30-MHz-wide signal is a real chore. The traditional types also require a much stronger signal, so extra stages of i-f amplification and limiting were needed. The result offered only marginally better performance over our final 564 design.

We also tried a 70-MHz-to-35-MHz divider so that the 564 would operate com-

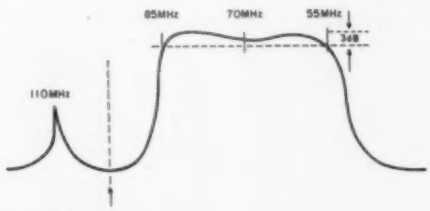


Fig. 6. Typical scope display. A spike will show up on the display at 110 MHz if the sweep generator is set to sweep too wide. This will not cause a problem. It is the second harmonic of the 55-MHz coil resonance.

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pletely within its specifications. Only slightly better performance was obtained, primarily reduced smearing of bright colors. The divider approach required extra i-f amplification, too. So back to the Signetics NE564 and its simplicity.

NE564 Specifications

The NE564 maximum specifications which concern us are as follows: pin 1—12 volts dc, pin 10—6 volts dc, for a 75-MHz lock frequency at 0 degrees Centigrade. We reduced the pin 1 supply voltage to 8 volts dc and made the pin 10 voltage-controlled-oscillator (vco) supply voltage adjustable through a 1k pot. To try to keep the 564 as cool as possible, a small IC-type heat sink is glued to its top. Otherwise, the circuit is the "typical" FM demodulator circuit from the Signetics application notes. The circuit is very simple and gives excellent results. Although the PLL is being pushed a little beyond its specifications, we have found only one 564 out of half a dozen that gave marginal performance. The marginal performer only lasted an hour; it probably was defective to start with. Again, as with the MWA-120s, you should buy your 564 from a reputable supplier and avoid the surplus outlets. You might want to buy an extra just in case yours doesn't want to hack it at 70 MHz.

Circuit Description

Refer to the video demodulator schematic, Fig. 7. The output of the 564 is dc-coupled to the base of a 2N2222 transistor. The

Video Demodulator
Parts List

1 NE564 IC
1 NE592 IC
3 2N2222 transistors
1 7808 voltage regulator
1 7815 voltage regulator
1 1k-Ohm pot, PC board mount
1 10k-Ohm pot, PC board mount
1 2-8-pF variable capacitor, Erie type 538-006A-2-8, or Erie type 518-000A-2.5-9
1 100-uH choke
1 2.7-uH choke
1 4.7-uH choke
1 47-Ohm resistor
1 100-Ohm resistor
4 150-Ohm resistors
1 270-Ohm resistor
3 470-Ohm resistors
1 510-Ohm resistor
1 560-Ohm resistor
2 1k-Ohm resistors
1 2.2k-Ohm resistor
1 4.7k-Ohm resistor
4 10k-Ohm resistors
1 12k-Ohm resistor
1 22k- to 47k-Ohm resistor, see * on schematic
6 .01-uF disc ceramic capacitors
3 1-uF, 35-volt tantalum capacitors
1 22-uF, 16-volt capacitor
1 470-uF, 16-volt capacitor
1 6.2-volt zener diode
1 MDB-101 hot-carrier diode (1N914 will probably work)
2 3-pF silver mica capacitors
1 91-pF or 100-pF silver mica capacitor
1 300-pF silver mica capacitor
1 330-pF silver mica capacitor
2 2200-pF silver mica capacitors, or any combination equaling total capacitance of 4400 pF

Note: All resistors ¼-Watt, carbon composition.

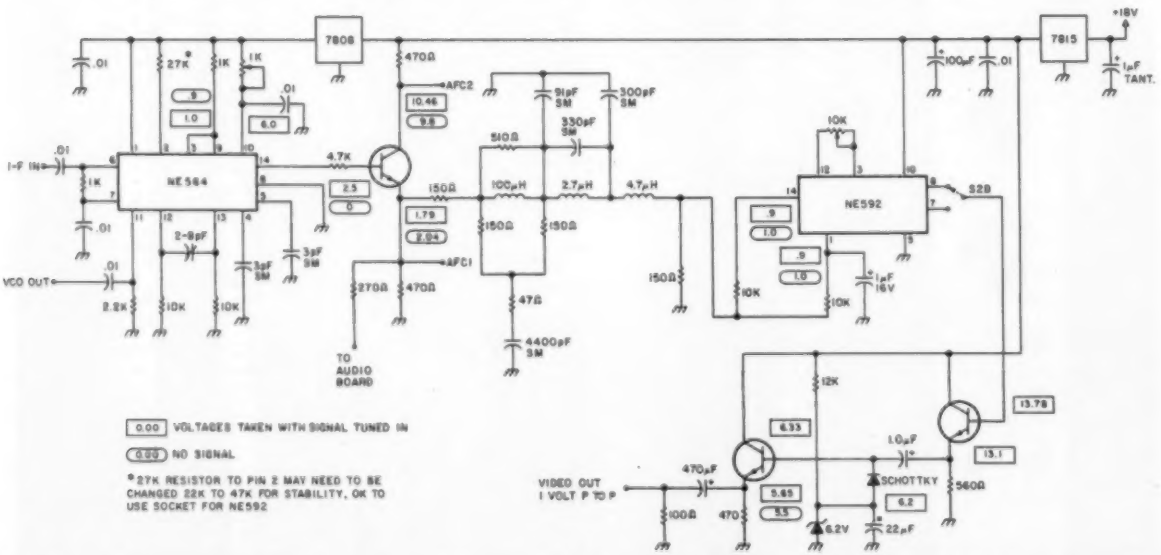


*Fig. 7. Video demodulator schematic. The vco capacitor is an Erie type 538-006A-2-8 or 518-000A-2.5-9. All transistors are 2N2222 or 2N706. Set the 1k pot on the NE564 pin 10 for 5 volts. Set the vco to 70 MHz. After the picture is tuned in, adjust the 1k pot for best picture. The pin 10 voltage should be between 4.7 V and 6.0 V. *The 27k resistor to pin 2 may need to be changed (22k to 47k) for stability. It is OK to use a socket for the NE592.*

audio and AFC-1 pickoff points are at the emitter of this transistor. The AFC-2 junction point is on the collector of this transistor. The de-emphasis filter also connects to the 2N2222 emitter, and then goes through an audio trap to the NE592 video amplifier.

The NE592 has complementary outputs, which makes it simple to provide video reversal (not all transponders use the same video polarity). The output of the 592 feeds the base of another 2N2222. The emitter of the second 2N2222 is ac-coupled to the base of a third 2N2222 whose base is clamped with a zener diode and a hot-carrier diode to keep the 30-Hz energy dispersal waveform from appearing at the video output. The 30-Hz component, if not removed, will wreck your vertical sync. The 1-volt video output is ac-coupled and terminated with a 100-Ohm resistor.

Construction

To make construction really simple, a PC board layout and parts overlay is provided. See Fig. 8. The PC board is double-sided G-10. The parts overlay is shown in Fig. 9.

For easiest assembly, install all resistors first and then the capacitors and chokes. Transistors are installed next, being sure that they are properly inserted. Power up the board and check the ouput of the voltage regulators for correct voltage before inserting the ICs. Save the ICs for last. You can use a socket for the NE592, but do not use a socket for the NE564.

Tune-Up

The joy of using the NE564 becomes evident when you get to the alignment procedure. Set the 1k pot and 10k pot at mid-position. Apply power. Adjust the 1k pot for 5 volts dc on pin 10 of the 564. Connect a frequency counter or grid-dip meter to the "VCO out" point on the board and adjust the variable capacitor for a 70-MHz vco frequency. Assuming that you have the rest of your system working, connect the output of the 70-MHz filter i-f amplifier board to the video demodulator board. With a video monitor attached to the video output, you should have satellite TV! Congratulations!

The final adjustment is made while watching video on your TV. Adjust the 10k pot for 1-volt video out or at least good contrast on your monitor. Now is the time to adjust the 1k pot on pin 10 of the 564. Monitor the pin 10 voltage while adjusting the pot. Changing

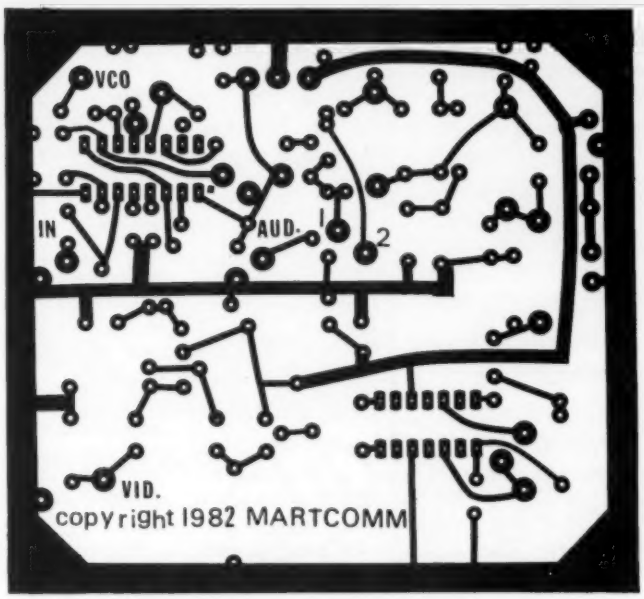


Fig. 8. Video demodulator PC board.

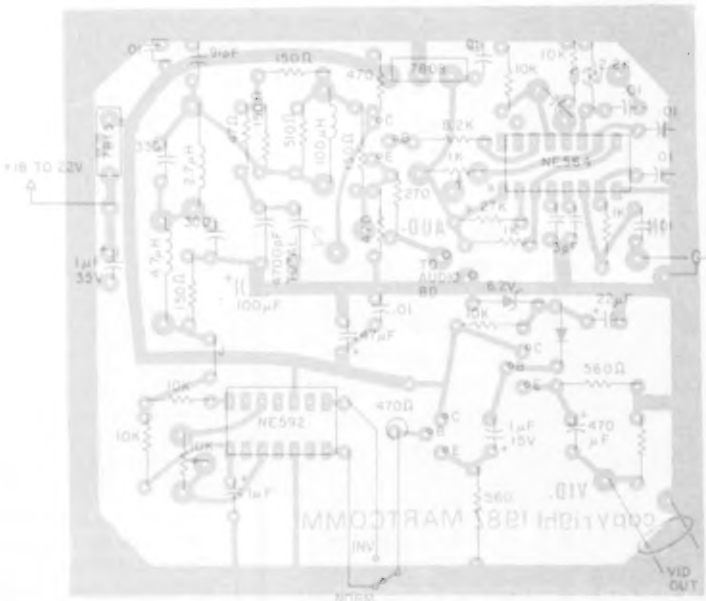
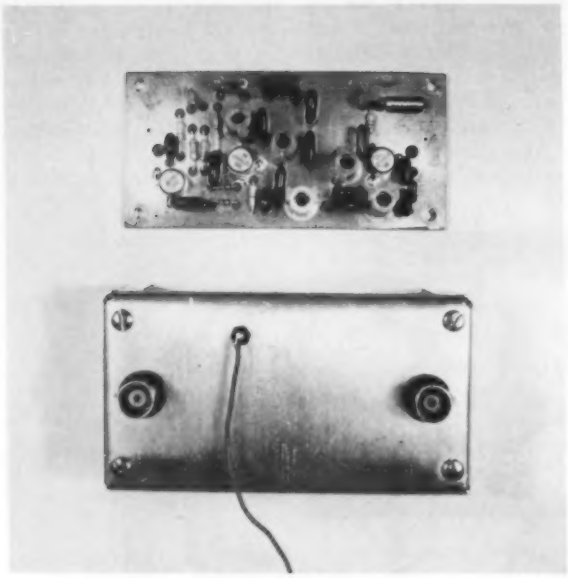
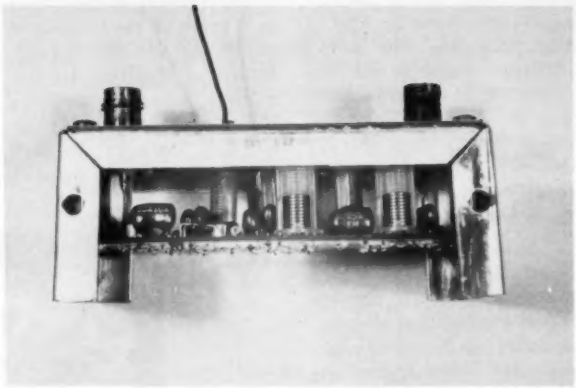


Fig. 9. Component layout for video demodulator board.



The 70-MHz bandpass filter and i-f amplifier before installation in its case.



Side view of the filter/i-f unit after its installation in the case.

the voltage on pin 10 also changes the frequency of the vco, so readjust the vco capacitor for 70 MHz after every voltage change. Do not, however, exceed 6 volts on pin 10. Adjust the two pots alternately for best picture and minimum color smear.

If you don't have video, check the voltages as shown on the schematic. The values in a rectangular box are with a signal tuned in, and the voltages in the oval boxes are with no signal.

Please, if you write us concerning any of the articles and want an answer, send a self-addressed, stamped envelope for our reply.

Printed circuit boards are available from Martcomm, Inc., PO Box 74, Mobile AL 36601. The 70-MHz bandpass filter i-f amplifier board is $12.50 plus $1.75 for first-class postage and handling. The video demodulator board is $25.00 plus $1.75 for first-class postage and handling. Boards for other parts of a satellite TV receiver are available from Martcomm, Inc. Send an SASE for a flyer on availablility and prices. ■

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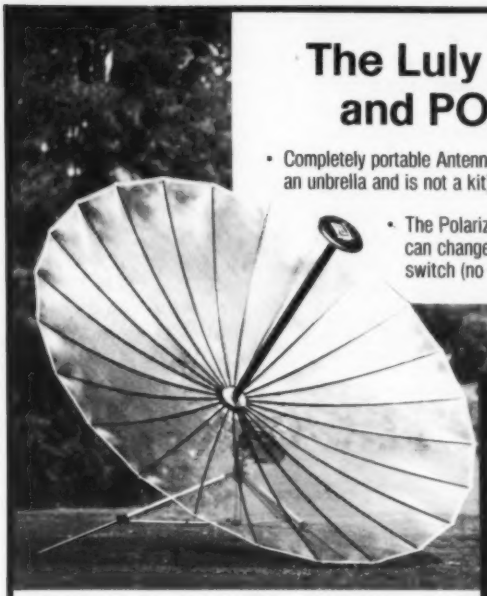

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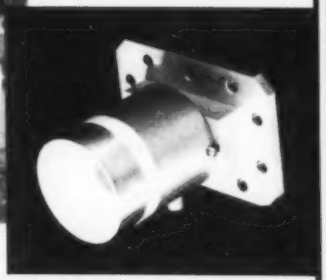

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TVRO Sound Decoders

—Satellite Central, part VI

There is more than just video up there! Besides the Lucy reruns, you can find special news and entertainment goodies, most of which are carried on separate subcarriers or in the TV vertical interval.

For the moment, let's cover just the subcarrier services. While 6.2 MHz and 6.8 MHz are the usual frequencies used for satellite TV audio, other frequencies can be found with such things as background or stereo music, not to mention data and clandestine transmissions. But a typical TVRO receiver may have only two fixed-frequency audio detectors, leaving you wanting more!

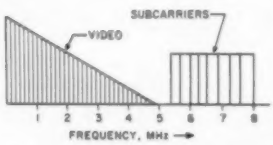

Fig. 1. FM subcarriers are located above the video. 6.8 MHz is the most-used frequency for TV sound. An additional eight more 15-kHz audio channels are possible without significant intermod.

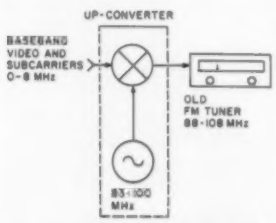

Fig. 2. Use a good mixer and upconvert the video and subcarrier baseband to the commercial FM band for detection on your stereo. Shielding from local interference is very important.

How Does It Work

Most satellite audio services are carried on FM subcarriers, but sideband audio does appear in several places. At the uplink site, the subcarrier is applied with the video to the main FM video carrier. Once the main carrier is detected in the receiver, the combined video and audio are split. The video must be de-emphasized and the dispersion waveform clamped out (see "Satellite Central," *73*, December, 1981, p. 54). But the audio subcarrier still must be demodulated. It is fed through a high-pass filter to a tuned FM detector.

The usual transmission format is wideband FM deviating the subcarrier ±75 kHz or so. Seventy-five μsec pre-emphasis is used. If this sounds strangely like commercial FM, you're right! But the wider bandwidth possible from the video demands that the FM sound subcarrier be placed higher up in frequency than typical TV sound (4.5 MHz). You may find carriers anywhere from 5.4 MHz to nearly 8 MHz, as seen in Fig. 1.

You can try several ways to detect satellite subcarriers. Surplus decoder units found at swap meets such as the tube-type Collins SC100C subcarrier demodulator work fine. Just connect a power supply and retune for whatever frequency you want. The coils on the Collins units are easy to tweak. While you can tune by ear, a signal generator always helps.

Another clever way is to mix the subcarrier with a local oscillator and shift it up in frequency to feed a conventional FM tuner. The configuration in Fig. 2 works very well if your tuner is well shielded from local FM interference. Bargain-basement transistor radios don't work too well in this capacity, but some of the old tube-type (low sensitivity) tuners gathering dust in the junk box seem to be perfect. The main advantage to this technique is the ease with which you can tune and the feeling

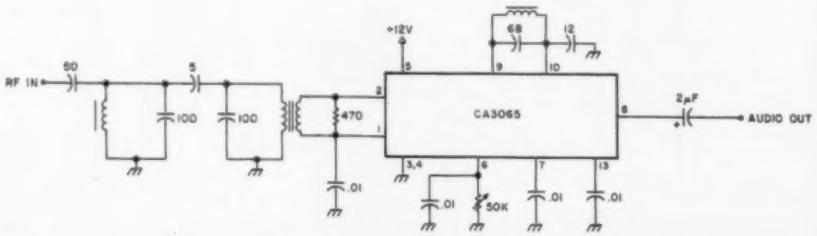

Fig. 3. A typical FM subcarrier decoder. The tuned circuits are adjusted to resonate at the desired frequency. Additional prefiltering may be necessary for best quality. Pin 6 can be grounded for maximum output.

of infinite cleverness or wisdom you may enjoy when you recycle useless junk!

The Universal Circuit

Or you can build a fixed-frequency detector. The most popular circuit in use today is one using a single IC. Known by such names as the LM3065, CA3065, or MC1358, this simple chip is nothing more than a quadrature detector which forms the guts for most TV-set sound circuits. See Fig. 3. The subcarrier feeds a bandpass filter tuned to the appropriate frequency which in turn feeds the chip for detection and de-emphasis.

Deep in its heart of darkness, the chip amplifies the signal into limiting before it is detected. In addition, the chip also contains an electronic attenuator and an output driver amp. A variable resistor from pin 6 to ground controls the electronic attenuator. Minimum resistance gives maximum volume. The distortion specs on the amp are not too sweet so it is best ignored. Besides, you can get nearly 0 dBm out of the bare detector, anyway—more than enough to ionize the plastic transistors in any amplifier.

You can build one of these detectors in an evening, but there is a better way. Buy it already built! As I've mentioned before, regular TV sound detectors are just about the same thing, circuitwise, except that they are tuned to 4.5 MHz. They differ from satellite audio ever so slightly in frequency, de-emphasis, and bandwidth. Interestingly enough, the entire sound section for an RCA XL-100 TV contains just such a circuit on the small PC card seen in Fig. 4.

Build It Quick and Dirty

The XL-100 sound modules are available at most TV distributors. They cost about 15 dollars and are a bargain when you consider what your time is worth these days to build one from scratch. Order an RCA part number MAA001A.

The units come tuned to 4.5 MHz for TV sound. Just a few mods will make them tunable from 5 MHz to nearly 8 MHz. Change the value of C290 to 50 pF. Also change C295 to 25 pF. This will shift the unit from 4.5 MHz to about 6.5 MHz. Then solder a .01-μF capacitor from pin 13 on the chip to a ground trace. This sets the de-emphasis to 75 μsec.

Build a well-regulated supply the easy way by using a molded plug-in dc charger/power supply connected to a large-value capacitor and a 3-terminal regulator as seen in Fig. 5. Just be sure to include the capacitor on the output of the regulator or it will quickly lose its cool in the worst way.

Everything should fit into a small 2 × 5 box even if you use a soldering gun rather than a pencil iron. See Fig. 6 for an idea on layout. Use whatever connectors you have in your junk box. Nothing is critical except for the mandatory use of coax from the receiver to the unit. The tap-off in the receiver is simply the same place the other sound detectors connect, usually right after video detection.

Tune-up is easy. Use your ear and twist T299 and L299 until you hear sound. A better way is to feed your signal generator into the unit while looking at pin 9 on the chip with a scope. Once you see rf, back down the generator below limiting (done by the chip) and peak T299 and L299 for the frequency you want. If you can frequency-modulate the generator, by all means do so and set it for ±75-kHz deviation. Then look at the demodulated audio and adjust L299 for the best waveform. A THD analyzer can be used to improve the distortion specs with a variable resistor in parallel with C295 and L299 to lower the Q.

Next, align the bandpass-filter coils simply by peaking. You may not need the coils at all depending on the prefiltering done in the receiver. The ideal coil adjustment method is to first peak everything including L299. Then short the second coil with a 10-Ohm resistor (you'll need more umph from the rf generator) and peak again. Remove the resistor, back down the generator, and re-peak the second coil.

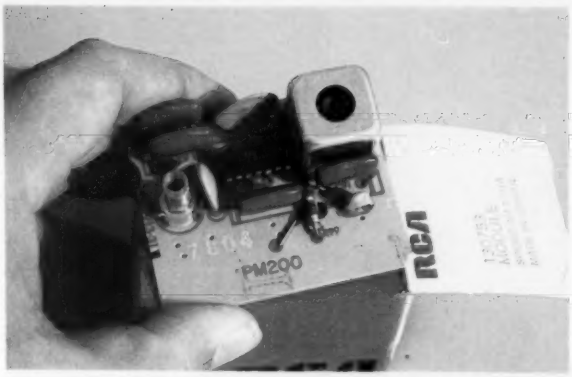

Fig. 4. Known by TV servicemen as the PM200, this small card holds nearly an entire TV-set sound section. It's a natural for cheap satellite audio recovery.

Bells, Whistles, and Distortion

If the subcarrier decoder is intended as a TV sound detector, you'd better leave the 50k volume-control pot in the circuit so that you can adjust audio drive to a subsequent rf remodulator. If you are feeding another amp, you could just as well forget the pot by grounding pin 10 on the board (pin 6 on the chip). This will set the output at maximum, about 0 dBm across 600 Ohms using a 12- to 16-volt supply.

You can save in the amplifier department, too. The amplifier for an RCA XL-100 is also available. Order MAN002A and use the circuit in Fig. 7 for intercon-

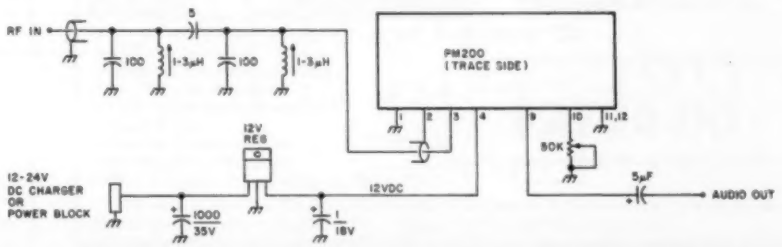

Fig. 5. The PM200 becomes an FM subcarrier decoder with three mods and a few external parts. Use your ear or an rf signal generator to tweak it into operation. Forget the input bandpass network if the receiver already has a high-pass filter for subcarriers.

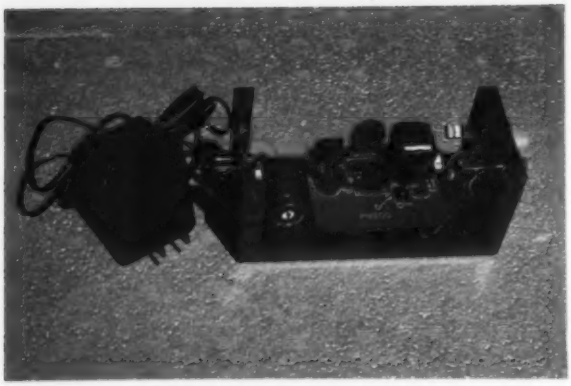

Fig. 6. Everything but the charger/dc supply should fit in a small box. The PC board already has a hole in it for 6/32 hardware. Mount it on a fiber or plastic standoff.

nection. You'll need a nominal 24 to 26 V dc supply at slightly more than an Amp. Don't expect very hi-fi sound at all.

Subcarrier hunting can be fun. I've discovered some really weird stuff as I dial up and down the band. The list of sources in Table 1 is a good start. So is this project when it comes to jumping into your first home-brew TVRO gadget. Because so many subcarrier frequencies are used, you almost always can use another decoder. We've just scratched the surface of what soon will become that "big database in the sky."

The time is right for you to join in the fun of receiving TV from space. If you have a question regarding the topics we cover here, feel free to drop me a line (letters only, no calls please). Sorry, I can only answer mail that is accompanied by a SASE.■

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	7.695 mono	Seeburg lifestyle music
6 WTBS	6.2 slow scan	UPI Newstime pic and audio
	7.4 slow scan	Woman's Channel pic and audio
	7.4	JISAL easy-listening music
8 CBN	5.58/5.76 L & R stereo	Adult contemporary music EST
	5.94/6.12 L & R stereo	Adult contemporary music CST
	6.30/6.48 L & R stereo	Adult contemporary music PST
	7.56	News
11 MTV	5.80/6.62 L – R & L + R stereo	Music Television Pop Rock

Or listen to what Bob Cooper calls "Good Morning Siberia" on the Russian polar orbit Molniya birds. Look for a signal near 3895 MHz (transponder 10). Then tune your subcarrier detector to 7.5 MHz for an earful!

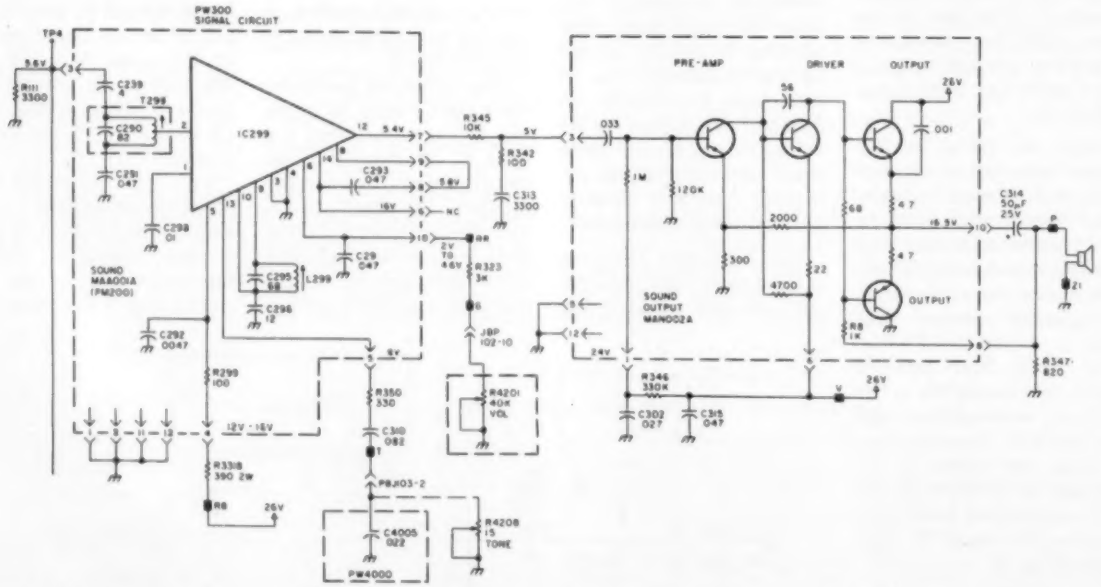

Fig. 7. The PM200 with its companion audio amp form the entire sound section for an RCA XL-100 TV . . . and a cheapo satellite receiver! Don't expect anything but soup-can quality. Your best bet is to skip the XL-100 power amp and simply feed pin 8 on the PM200 through a blocking capacitor to a good amplifier.

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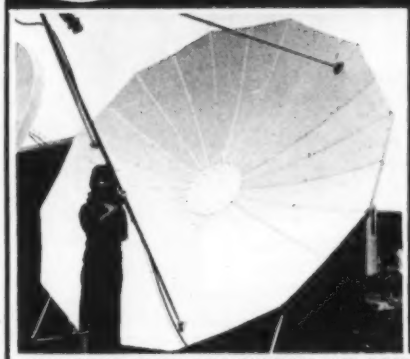

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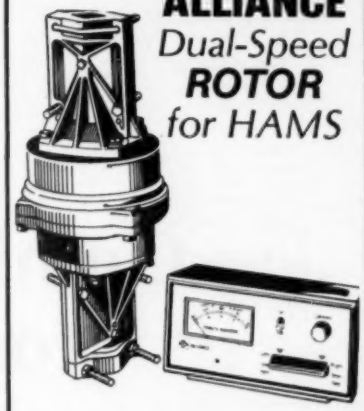

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This antenna is a coaxial collinear with 9 dB gain over a dipole. The pattern is omnidirectional and works well for both ATV and FM service. While building the Mount Wilson ATV repeater, I explored an antenna system that would give omnidirectional coverage and have as much gain as was practicably available. Another consideration was environmental problems such as extremes of temperature and icing.

Commercially-manufactured antennas are available for the 432-MHz band even though their price tags are high. There are no commercially-manufactured gain vertical antennas for the 1241-MHz band. I needed antennas for both the repeater input of 434 MHz and the output of 1241 MHz; since I did not want to spend a bundle on the 432-MHz antenna, I decided to home-brew it.

The antenna is in the collinear family with its elements made of RG-213 coax stacked one on top of the other. The main elements are ½ wavelength and can be calculated from the formula 5904 divided by the frequency in megahertz (equals element length in inches). The next step is to find the velocity factor of the coax that will be used. I chose RG-213 as it has a good tight shield and a constant velocity throughout its length. RG-8A/U can also be used as long as it has a solid dielectric and tight-knit shield.

The last step is to multiply the element length by the velocity factor (.66 for RG-213) to yield the actual length; in this case, 8.9 inches for 434 MHz. This formula can be used for any frequency and coax.

Elements are transpose-connected at the end of the half-wave elements so that the phase of the signal is 180 degrees out of phase from the other end of the element. See Fig. 1. As the signal travels up the elements, less signal reaches the top because of radiation, so more elements are used to get the same gain, as with stacked dipoles but without the complicated phasing harness. A quarter-wave element is used at the top and bottom of the array to match the 52-Ohm feedline at the bottom and the whip at the top of the antenna.

If 6 dB is desired, 8 elements can be used, and 16 are used for 9 dB. A slight downtilt of the pattern can be obtained by cutting the elements three percent shorter. (Downtilt is desirable if the antenna is to be installed on a mountaintop.) Any small amount of vswr can be minimized by the quarter-wave stub and trimmer capacitor in

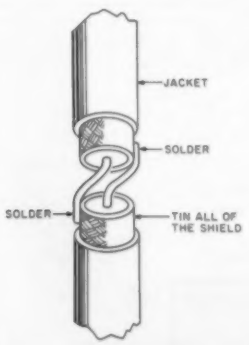
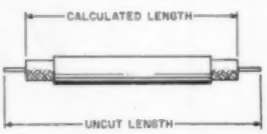


Fig. 1. Coax connection.



	Calculated Length	
	434 MHz	1250 MHz
¼λ whip	6¾"	2⅓"
¼λ element	4½"	1½
½λ element	8-7/8"	3"

Fig. 2. Coax preparation.

the matching decoupling section.

Construction

Add one half inch to the calculated length to allow for exposing the center conductor so it can be connected to the other element. See Fig. 2. Cut the jacket, shield, and dielectric with one cut. A sharp knife or X-acto® miter saw should be used to make the cut. After all the elements are cut to length, then cut the jacket back three-eighths of an inch and tin both the center conductor and shield using a 25-Watt iron—too much heat will melt the dielectric.

Now that all parts are tinned, solder the parts together with a maximum of one-eighth-inch separation between elements. After completion, check for shorts by visual inspection as the antenna is at dc ground. Excess flux should be scraped off, but do not use any chemical flux remover as it can contaminate the dielectric. The whip on the top is connected to both the center and shield. The matching section is a quarter-wave coax stub shorted at both ends and a piston trimmer capacitor. See Fig. 3.

Tune-Up

Adjust the trimmer for minimum vswr. If the minimum is at one end of the trimmer, then adjust the spacing of the stub to feedline distance. One-eighth inch is normal for the spacing.

Housing

The antenna is housed in PVC pipe. The heavy wall is the one to use and it is also known as schedule 40 PVC. One-inch diameter can be used for either the 1241-MHz model or the 434 model, but if the antenna is to be mounted as a free-standing antenna, the 434-MHz housing should be tapered. This can be done with ¾-inch, 1-inch, and 1¼-inch pipe. The pipe may need to be heated to make a better fit. Pipe caps are used to keep the rain out of the housing and the bottom should be open so it can breathe. The antenna can be mounted one half wavelength from a mast for a cardioid pattern and the gain will increase 2 dB over that of an omnidirectional pattern. See Fig. 4 for the patterns.

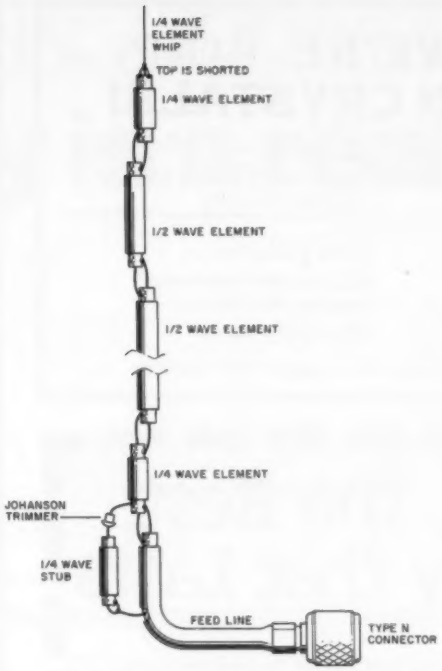


Fig. 3. 8 elements = 6 dB. 16 elements = 9 dB.

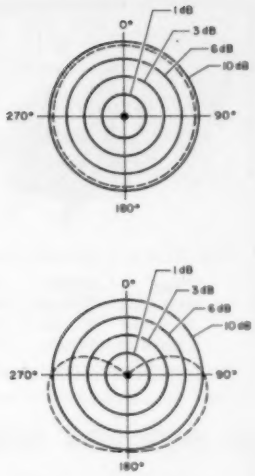


Fig. 4. (a) Omnidirectional pattern. (b) Cardioid pattern.

Conclusions

Construction time is one to two evenings. Take your time and you will have a better working antenna. The 434-MHz version has been in use for one year now on Mount Wilson and has survived all four seasons from 100 degrees heat to snow and ice. Many of these particular antennas in Los Angeles and San Diego have been built and used with the same results as I have obtained. Recently, a second 1241-MHz version was installed on Mount Wilson for the aural transmitter on the ATV repeater. It is identical to the one used for the visual transmitter and the results have been good.

Acknowledgements

I would like to thank Jay N6BDT for his help in testing the antenna, and also all others who helped me in this endeavor. ■

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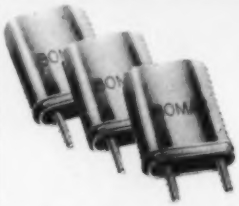

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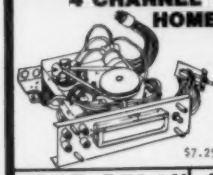

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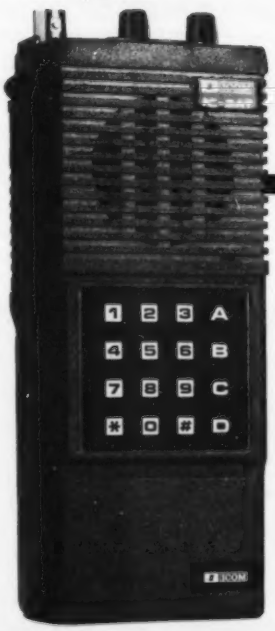

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The primary purpose of an rf matching unit is to ensure that the output of the transmitter (transceiver, amplifier, receiver) looks into its design output impedance, usually 50 Ohms in today's equipment. The matching units available today can transform complex impedances as high as several hundred and often as low as ten or twenty Ohms into the 50-Ohm resistive load that the radio was designed for. But there are other reasons for using an rf matching unit. These additional benefits will improve your station's operation even if your rig is already working into a perfect match.

Rf matching units often provide increased attenuation of harmonics and spurious signals due to additional circuit Q and the filtering action of many types of matching networks. The degree of this benefit depends on the type of matching network employed, so let's quickly review the popular types available from manufacturers and described in handbooks.

Network Types

The L-network (Fig. 1) makes up the simplest type of matching unit, consisting of a variable capacitor and a tapped coil. It may be used in combination with a pi-network to form a most effective pi-L matching network. The L-network alone is frequently employed in the simplest and least expensive matching units. The range of

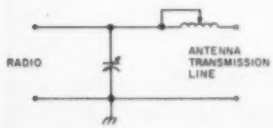

Fig. 1. The L-network.

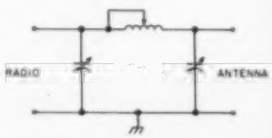

Fig. 2. The pi-network.

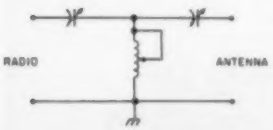

Fig. 3. The T-network.

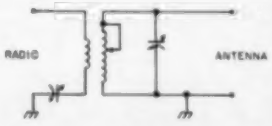

Fig. 4. Inductive-coupling network.

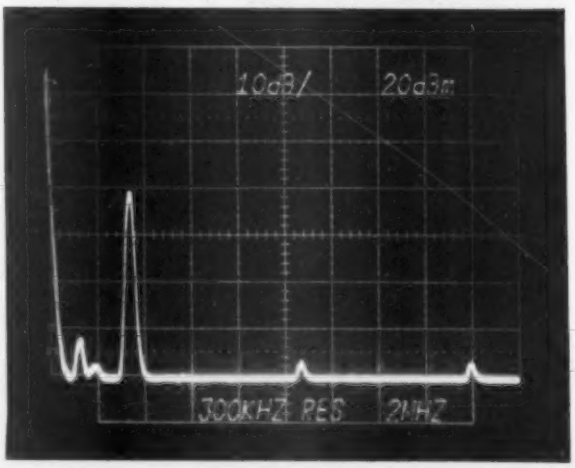

Photo A. Two-Watt QRP solid-state rig on 3.5 MHz without rf matching unit.

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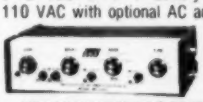

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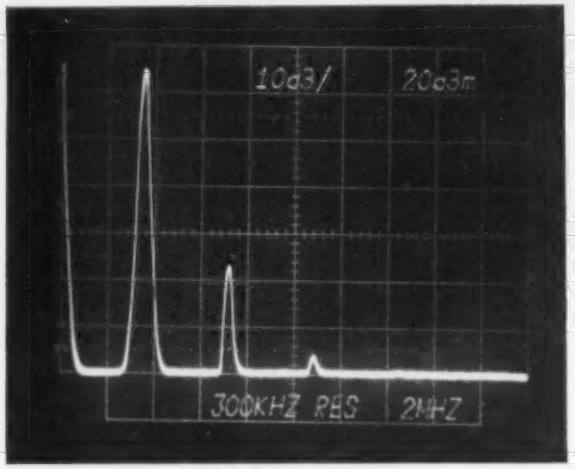

Photo B. Tube-type kilowatt at 3.5 MHz without rf matching unit.

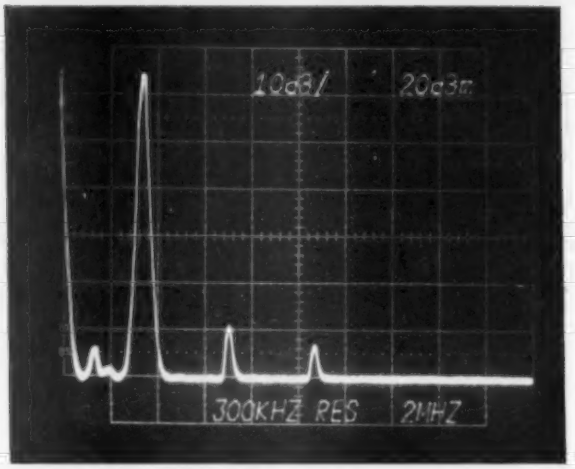

Photo C. Solid-state exciter driving kilowatt amplifier at 3.5 MHz without rf matching unit.

impedances it can match is limited.

The pi-network (Fig. 2) is the same network used at the output of many modern transmitters' final amplifier stages. Such a network external to the transmitter can be added to provide increased matching capability. The common pi-network will include two variable capacitors working against ground and a tapped, series coil. This type of arrangement has the network acting as a low-pass filter that serves to reduce harmonic output. An example of a matching unit using the pi-network in this way is the Drake MN-2700.

The T-network (Fig. 3) usually will consist of a combination of two variable capacitors on each side of a large tapped coil. This network can match a very wide range of impedances but may not provide significant harmonic attenuation under some circumstances. Examples of the T-network include the famous "Ultimate Transmatch" and many commercial models available from a host of manufacturers, including the Dentron MT-3000.

Inductive coupling (Fig. 4), consisting of two coils air-coupled together and associated capacitors for tuning, allows a matching unit to function as a band-pass-type filter showing modest attenuation of frequencies above and below the operating band. A classic example of this type of unit is the Johnson Matchbox.

Test Results

Now let's take a look at some of these matching units in action in situations where a 1:1 match already exists between antenna and transmitter.

Photo A is the display on a spectrum analyzer showing a modern-design, solid-state QRP transmitter delivering two Watts at 3.5 MHz to a dummy load. Starting at the left (the high vertical peak along the border is the analyzer reference signal and is to be disregarded), each horizontal scale division is set for two megahertz and each vertical division is 10 dB. A third harmonic can be seen down about 35 dB just past center scale at 10.5 MHz. Up further, what appears to be the fifth harmonic is attenuated just a bit more. Below the fundamental are spurious signals appearing in the broadcast band (−31 dB) and in the

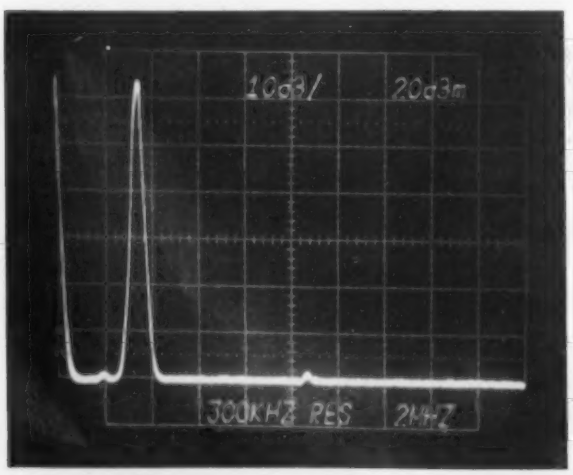

Photo D. Same equipment as in Photo C but with the addition of antenna matching unit.

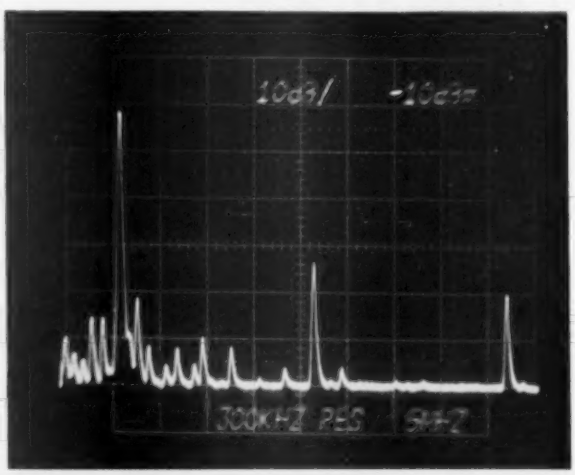

Photo E. Solid-state transmitter at 21.1 MHz without antenna matching unit.

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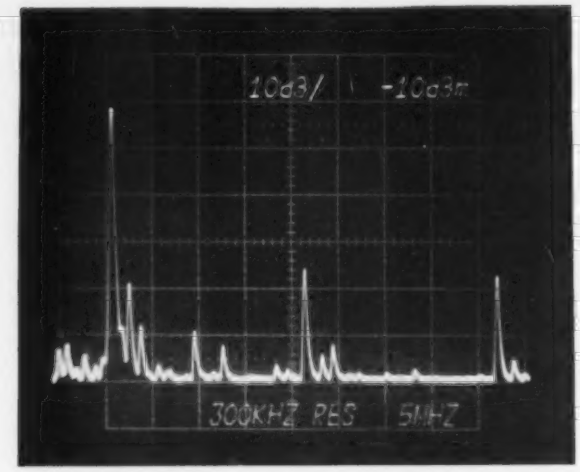

Photo F. Rf matching unit with T-network added to the equipment used in Photo E.

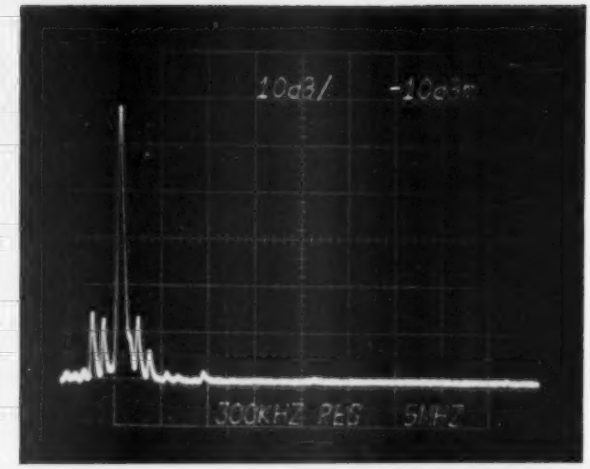

Photo G. Rf matching unit employing pi-network instead of T-network, with the Photo E equipment.

160-meter band (−38 dB). No rf matching unit is in the circuit. If it were not for the low power level of this transmitter, it wouldn't meet today's FCC rules for attenuation of spurious and harmonic emissions.

Photo B shows a twenty-year-old tube-type transceiver operating at the same frequency and driving a similar vintage kilowatt amplifier for 600 Watts output. Notice the second harmonic near 7 MHz down about 40 dB, and the third harmonic down almost 60 dB. Of course, the fundamental is about 25 dB stronger than the same signal generated by the QRP rig. Again, no external rf matching unit is used.

Photo C shows the spectrum produced by one of today's higher-priced solid-state rigs driving a modern kilowatt amplifier to 600 Watts output on the same frequency. Note that the harmonics have been further reduced but spurious signals, generated by the solid-state transceiver, are present below the fundamental. Although these spurious signals are down about 60 dB, there may still be the potential here for BCI in neighborhood radios.

Photo D shows the result of adding an antenna tuner to the transmitter/amplifier combination in Photo C. An already clean signal has been made "sparkling clean" by still further reduction of harmonics and spurious signals. The result is less spurious signal being radiated by the kilowatt station (*with* antenna matching unit) than by the QRP station (without antenna matching unit). All equipment was connected to a 50-Ohm dummy load so that in all cases the swr was 1:1, with or without the matching unit.

In Photo E we see a partial spectral display of a QRP solid-state transceiver operating into a dummy load on 21.1 MHz. The horizontal divisions on the analyzer are now 5 megahertz each with the vertical scale remaining at 10 dB per division. Around 42 MHz is a second harmonic down about 30 dB, with a third harmonic down 38 dB and a large assortment of more significant spurious signals between 15 and 40 MHz, down 38 to 45 dB. There is no matching unit at the output of the transceiver.

Photo F shows the result of adding a popular antenna tuner incorporating a T-matching network. A dif-

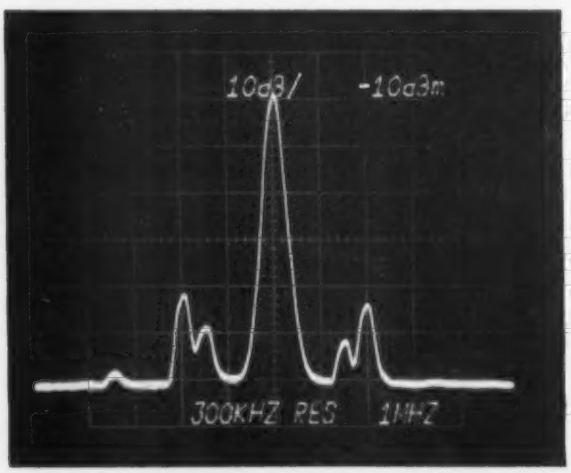

Photo H. Solid-state QRP transceiver operating at 29 MHz without rf matching unit.

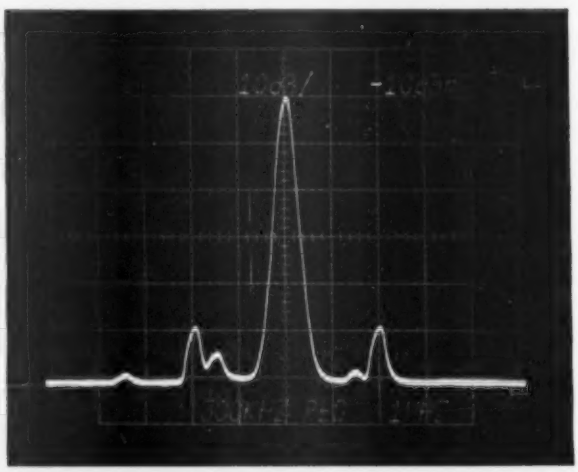

Photo I. Pi-network rf matching unit added to output of the transmitter used in Photo H.

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ferent distribution of spurious signals results, but no significant improvement.

In Photo G, we see the results of substituting an antenna tuner with a pi-network. Notice how this unit functions as a low-pass filter, greatly attenuating spurious signals above about 24 MHz.

Photo H shows a close-in view of a 29-MHz signal peaked at the center of the display with each horizontal division equaling 1 megahertz. Spurious signals are shown at 27 MHz (−42 dB) and at 27.5, 30.5, and 31 MHz.

In Photo I, the addition of a pi-network matching unit shows about an 8-dB average reduction in the close-in spurious signals. (The higher harmonics such as 58 MHz and above have been practically eliminated but are not shown in this picture.) Without the matching unit's effect, this 8-dB reduction in the strength of the spurs would have been achieved only by the reduction of the main transmitting power from, say, 100 Watts to about 16 Watts.

There are, of course, tuner trade-offs for the additional benefits provided by the matching units. Some power is lost in the matching unit, but if large-size, good-quality components are used in a unit's construction, these losses can be held at a few percent or a fraction of a dB. For portable operation, the additional bulk of another unit is a consideration, and with solid-state rigs the need to do some tuning is another factor.

The result is always a cleaner signal, however. When the amateur station is running a kilowatt, even a spur attenuated 40 dB can cause problems. In all cases, a matching unit is a good tool to control air pollution in the radio spectrum. ■

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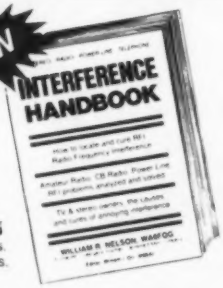

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✓See List of Advertisers on page 130

Dr. Richard L. Schatz WA3GWY
Box 31A, RD #1
Sugarloaf PA 18249

Americanizing the German Quad

— the world's best antenna?

One beautiful day in June over three years ago, Joe W3LDV came over to my house, as he often does, only this time he had a special purpose.

"Hey, you love antennas! Have you read about this one in the latest issue of *73*?"

Having a 100-foot tower with a tribander and phased two-meter arrays, plus inverted vees and various slopers (not to mention a Mor-Gain folded dipole), I did not need any new antennas on my farm!

Such being the case, my response was "What kind is it? Have you tried it? Have I got enough room? Let's try it anyway!"

He produced the June, 1978, issue of *73 Magazine* and we got down to a serious discussion over cups of coffee.

This article was written by Christof Janker WD4CPK/DF3TJ of West Germany. He described a big quad that was mounted parallel to the earth and which was usable on all bands. The results he showed were almost phenomenal. His quad rivaled, yes, excelled, a two-element yagi beam. Joe, an active ham for many years and certainly longer than I have been, explained that by the appearance of this design there was much promise to its operational characteristics. We set about to get halyards into appropriately spaced trees.

Double-checking with the formula, L(feet)=1005/F (MHz), Joe and I erected a 69-foot-per-leg fairly square quad as described in Mr. Janker's article, using THHN insulated 7-stranded, 14-gauge wire, and fed it with a random length of 75-Ohm coax. We used plastic insulators on the four corners, tied our halyards to each of these, and pulled the antenna up (see Fig. 1). It was fairly square, but we found out that this is not critical. For horizontal polarization, we selected the feedpoint off one corner, according to its earth parallel elevation. The math said that this antenna would have its center resonant frequency at 3.6 MHz, and it did, with no further ado! At this happy point, we decided to do some listening and comparing to my other antennas. All comparisons were done against the following:

1) Inverted vees (80 and 40), apex at 90 feet, fed from common coax.
2) Mor-Gain folded dipole at 60 feet.
3) A 40-meter sloper, highest end at 90 feet.
4) An endfed Hertz (130 feet long) with coupler at 40 feet.
5) An 80-meter dipole at 30 feet.
6) A Mosley Classic 33 on top of my tower at 100 feet.

It took Joe and me about five minutes to determine that this thing showed superior receive quality to all of the above except the beam! Swr was perfect for 80 CW and 40 phone just the way it stood. Contrary to Mr. Janker's statement, all other bands presented a very high swr without the use of a coupler except for one. The unique feature was that the noise level was dramatically less on the quad than on any of the other test antennas. My shack is plagued with nighttime noise levels of an uninteresting degree due to local residents involved in welding, grinding, and other "anti-receiver" hobbies. When we switched on the quad, signals dramatically quiet were unintelligible on the other wires.

Transmitting tests showed a constant three S-units better report on the quad on 80 and 40 than on any of the other antennas (not counting the beam, of course). As Mr. Janker pointed out in his article, there appeared to be no directivity exhibited on either band, even though the antenna is two full wavelengths long on 40 meters.

We then shortened the German quad to center resonate at 3.9 MHz in order to try 75 phone, and all results were identical to the above, with one sad note: This length made all the remaining bands useless without a tuner. But the use of one provided the same happiness as before—excellent reports all the way around the spectrum, beating everything except the Mosley. The beam had about six S-units on the quad on 10,

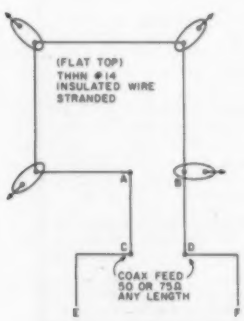

Fig. 1. Basic construction of horizontal quad.

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8 Conductor Rotor Cable	15¢/ft
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↙4

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Send and receive CW with MFJ's new CW transceive program and interface. Just plug-in interface, load program and operate. Gives you Tri-Split screen, 3295 character buffer, 10 memories, "Fist Fixer."

All you need to send and receive CW.

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TRS-80 Models I and III CW Transceive program and interface lets you send and receive CW. No modifications to rig or computer.

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HARDWARE INTERFACE: Plugs between rig and computer. Noise limiter, 4 pole active bandpass filter, post detection filter, tracking comparator. Keys tube or solid state rigs. Tuning, transmit, ON LEDs. 6x1¾x3 inches. Aluminum cabinet. RF shielded. 9-18 VDC or 110 VAC with optional MFJ-1312 AC adapter, $9.95.

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Program listing.

```
10 CLS:CLEAR 2000
35 POKE 16422,141:POKE 16423,5
37 REM                  ======================================
40 REM                  PROGRAM BY DR.RICHARD L.SCHATZ WA3GWY
42 REM                  BOX 31A RD#1 PARADISE ACRES
43 REM                  SUGARLOAF, PA 18249
45 REM                  WRITTEN AUGUST 1978
46 REM                  REVISED & UPDATED FEBRUARY 1981
48 REM                  ======================================
50 REM                  QUAD RESEARCH & CONSTRUCTION HELP BY
52 REM                  JOSEPH BLIHAR W3LDV, TAMAQUA PA
54 REM                  ......................................
70 PRINT:PRINT:INPUT"WHAT IS YOUR NAME";N$
90 PRINT:PRINT"AMATEUR CALL":INPUTAC$
110 INPUT"WHAT LENGTH (IN FEET) IS AVAILABLE ON YOUR PROPERTY";L

130 INPUT"WHAT WIDTH (IN FEET) IS AVAILABLE";W
140 PRINT:PRINT"OUTPUT TO PRINTER (Y/N)":INPUT OP$:IF OP$="N"THE
N POKE 16422,88:POKE 16423,4
145 IF OP$="Y"THEN IF PEEK(14312)>128 THENCLS:PRINT"PRINTER NOT
READY!!CHECK AND REDO!!":GOTO 140
150 CLS:C=0:B1=0
190 LPRINTTAB(18)"AMERICAN QUAD CONFIGURATIONS BY DR.R.L.SCHATZ,
WA3GWY AND JOSEPH BLIHAR, W3LDV"
210 LPRINTTAB(28)STRING$(51,"*")
230 LPRINT"                "
250 LPRINTTAB(18)"*****  DESIGNED ESPECIALLY FOR ";N$;", ";AC$;"
 *****":LPRINT"                "
270 LPRINT"AVAILABLE LENGTH ";L;"   AVAILABLE WIDTH ";W:LPRINT"
 "
290 IF(LANDW)>50AND(L>60)OR(W>60)PRINT"YOU HAVE ENOUGH ROOM FOR
A FULL-SIZED  80 - METER GERMAN QUAD ANTENNA!":ELSE 370
310 PRINT"<1> FOR 160-40 TRIBAND":PRINT"<2> FOR ALL BANDS"
312 LPRINT"                "
315 INPUT AB:IF AB=1LPRINT"160-40 TRIBAND ANTENNA"ELSELPRINT"ALL
-BAND ANTENNA"
320 FQ=3.55:FL=1005/3.9:TW=1005/3.55:Q=FL/4
325 IF L=WTHEN J=LELSEIF L>WTHEN J=L:ELSE J=W:LE=1
330 IF AB=2THEN 510ELSE GOSUB 2050:GOTO 510
370 LPRINT"                ":LPRINT "YOU WILL HAVE TO CONSTRUCT A QU
AD WITH THE LOWEST CENTER FREQUENCY IN THE 40-METER BAND"
380 LPRINT"                "
390 IF(L>30)AND(W>30)THEN MQ=1
410 INPUT "WHAT IS LOWEST CENTER FREQUENCY(IN MHZ)THAT YOU WISH"
;FQ
420 LPRINT"LOWEST DESIRED CENTER FREQUENCY (MHZ) ...";FQ:LPRINT"
                "
430 FL=1005/7.2:TW=1005/FQ:Q=FL/4
470 IF FD < 8 THEN FD = 8
490 IF(L<30)OR(W<30)THEN 770
510 IF(NF=1)OR(MQ=8)OR(CQ=1)THENBQ=1
550 IF(AB=2)OR(MQ=1)THEN FD=(TW-FL)/2:FD=(FD*.6)+FD:SL=FD*.4
570 IF FD>28 THEN PRINT"AREA OF THE QUAD IS NOT LARGE ENOUGH; DE
SIGN WILL HAVE TO BE CONFIGURED":GOTO 770
590 IF BQ=1THENGOSUB 3000:GOSUB 2170
610 LPRINT"                "
630 IF MQ=1GOTO710
650 IF J>60 THEN GOTO 930
670 LPRINT"                "
690 IF B1=8 THEN 770
710 LPRINTTAB(20)"MINIATURE AMERICAN QUAD":LPRINT"                "
730 GOSUB 3000:GOSUB 2170:GOTO 930
750 PRINT:PRINT:PRINT
770 LPRINT"CONFIGURED (ALL-AVAILABLE SPACE) QUAD ANTENNA":LPRINT
"                "
790 PRINT:PRINT:PRINT:CQ=1:C=1
810 S1 = (Q-L)*2:S2 =(Q-W)*2
830 EL = (S1+S2)/2
850 IF EL<8 THEN J=J+EL:L=J
870 IF(EL)16) THEN CLS:PRINT"DESIGN CANNOT BE CONFIGURED WITH TH
ESE DIMENSIONS":GOTO 110
890 FL=2*W+2*L:TW=FL+2*EL
910 LPRINT"                ":GOSUB 3000:GOSUB 2170
930 INPUT"TO EXAMINE THE BAND CHARACTERISTICS OF THE ANTENNA, PR
ESS 'ENTER'";A$
950 LPRINT"                ":LPRINT"                "
970 CLS:GOSUB 1740
990 FOR I = 1 TO 11
1010 ON ERROR GOTO 2010
1030 READ A:IF TW=1THEN IF A<14.0 GOTO 1030
1032 IF CQ=1THEN IF A<7.0 GOTO 1030
1035 IF HL$<>""THEN IF A>30 GOTO 2020
1050 QW = 1005/FQ
1070 QD = 1005/A
1090 QX = QD/QW
1110 IF QX<.7THENLPRINT1/QX,A ELSE LPRINTQX,A
1130 IF(QX=>.402)AND(QX=<.488)LPRINTTAB(30);"SWR IS 1.5 :1 OR LE
SS"
1150 IF(QX=>.489)AND(QX =<.503)LPRINTTAB(30);"SWR IS 1.2:1 OR LE
SS"
1170 IF(QX =>.504)AND(QX =<.509)LPRINTTAB(30);"SWR IS 1.6:1 OR L
ESS"
1190 IF(QX =>.510)AND(QX =<.531)LPRINTTAB(30);"SWR IS 2.5:1 OR L
ESS"
1195 IF(QX<.505)AND(QX).550)LPRINTTAB(30)"1.8:1 OR LESS"
1210 IF(QX=>.532)AND(QX=<.536)LPRINTTAB(30);"SWR IS 2.6:1 OR LES
S"
1230 IF(QX=>.537)AND(QX =<.552)LPRINTTAB(30);"SWR IS 2.8:1 OR LE
SS"
1250 IF (QX => .993) AND (QX =< 1) LPRINT TAB(30);"SWR IS 1.4:1
OR LESS"
1270 IF(QX =>.979)AND(QX =<.986)LPRINTTAB(30);"SWR 2.6:1  - 2:1"

1280 IF(QX)1.8)AND(QX<2)LPRINTTAB(30)"1.8:1 OR LESS)"
1290 IF(QX =<.978)AND(QX =>.970)LPRINTTAB(30);"SWR  2.7:1 PLUS"
1300 IF(QX<.337)AND(QX).333)LPRINTTAB(30)"2:1 OR MORE"
1310 IF(QX =>.337)AND(QX =<.345)LPRINTTAB(30);"SWR 2:1 OR LESS"
1315 IF(QX<.245)AND(QX).242)LPRINTTAB(30)"1.7:1-2.8:1"
1320 IF(QX<.242)AND(QX).240)LPRINTTAB(30)"OVER 3.8:1"
1330 IF(QX =>.245)AND(QX =<.248)LPRINTTAB(30);"1.6:1 OR LESS"
1350 IF(QX=>.2402)AND(QX=<.251)LPRINT TAB(30);"SWR 1.4:1 OR LESS
"
1370 IF(QX=>.2519)AND(QX =<.2542)LPRINTTAB(30);"SWR 2.2-1.8:1 "
1390 IF(QX =>.2543)AND(QX=<.256)LPRINTTAB(30);"SWR 2.7-2.2:1"
1410 IF (QX=> .257) AND (QX =< .259) LPRINT TAB(30); "SWR IS 3:1
 OR MORE"
1430 IF(QX =>.35)AND(QX=<.38)LPRINTTAB(30);"SWR 2:1 OR MORE"
1435 IF(QX).161)AND(QX<.1625)LPRINTTAB(30)"2.1:1-2.5:1"
1445 IF(QX<.167)AND(QX).164)LPRINTTAB(30)"1.7:1-2.1:1"
1450 IF(QX=>.167)AND(QX =<.174)LPRINTTAB(30);"SWR 1.6 OR LESS"
1470 IF (QX=> .1258) AND (QX=< .128) LPRINT TAB(30);"SWR MIN. 2.
5:1"
1490 IF (QX => .124) AND (QX =< .125) LPRINT TAB(30);"SWR 2.2-1.
8:1"
1495 IF(QX<.122)AND(QX).120)LPRINTTAB(30)"1.5:1 OR LESS"
1510 IF (QX=> .122) AND (QX =< .1237) LPRINT TAB(30);"SWR 1.5:1
OR LESS"
1530 IF (QX=> .908) AND (QX=< .947) LPRINT TAB(30);"SWR 2.5-2.2:
1"
1540 IF(QX=>.847)AND(QX=<.848)LPRINTTAB(30)"SWR 1.6:1 OR LESS"
1545 IF(QX=>.8481)AND(QX=<.851)THENLPRINTTAB(30)"SWR 1.6-2.8"
1550 IF(QX).8239)AND(QX<.8243) THEN LPRINT TAB(30);"SWR 1.5:1 OR
 LESS"
1570 NEXT
1575 IF(A=148)AND(CQ=8)THEN2020ELSE IF(A=148)AND(CQ=1)THEN2010
1580 IFHL$<>""AND A=29.3 THEN 2020
1590 CLS:GOSUB 1740
1600 GOTO 990
1630 DATA 3.5,3.55,3.6,3.65,3.7,3.75,3.8,3.85,3.9,3.95,4.0
1650 DATA 7.0,7.025,7.050,7.1,7.125,7.150,7.2,7.225,7.250,7.275,
7.3
1670 DATA 14.0,14.05,14.1,14.15,14.2,14.225,14.250,14.275,14.3,1
4.325,14.35
1690 DATA 21.0,21.1,21.2,21.250,21.3,21.325,21.35,21.375,21.4,21
.425,21.450
1710 DATA 28.3,28.4,28.5,28.6,28.7,28.8,28.9,29.0,29.1,29.2,29.3

1730 DATA 146,146.2,146.4,146.6,146.8,147,147.2,147.4,147.6,147.
8,148
1740 LPRINTSTRING$(40,45)
1750 LPRINT "# OF WAVES","FREQUENCY","SWR"
1790 LPRINTSTRING$(40,45)
1795 IF C>8THEN 1830
1810 IF AB>8 LPRINTTAB(42)"SWR ON 160 METERS 1.8:1 OR LESS":LPRI
NT"                "
1830 C=C+1:IF C=1 LPRINT TAB(42) "***** 80 METERS *****"
1840 IF(C=6)AND(HL$<>"")THENRETURN
1850 IF C=2 LPRINT TAB(42)"**** 40 METERS ****"
1870 IF C=3 LPRINT TAB(42)"***** 20 METERS *****"
1890 IF C=4 LPRINT TAB(42)"***** 15 METERS *****"
1910 IF C=5 LPRINT TAB(42)"***** 10 METERS *****"
1930 IF C=6 LPRINT TAB(42)"***** 2 METERS *****"
1950 LPRINT"                "
1970 IF(C=3)AND(AB=1)THEN 1990ELSE RETURN
1990 LPRINT"SWR FROM 14.1 TO 21.5 IS OVER 2.5:1":LPRINT"SWR FROM
 28.8 TO 29.5 IS 2.2:1 OR LESS":LPRINT"SWR ON 2 METERS IS 1.5:1
OR LESS"
2010 LPRINT"                ":LPRINT"*** END OF COMP
UTATIONS":END
2020 PRINT:PRINT"DO YOU WANT TO ALTER THE DETUNING STUBS FOR 20-
10 METERS (Y/N)":INPUTDS$:IF DS$="N"THEN2040
2022 CLS:CT=CT+1:IF CT<2THEN QF=FQ
2025 TM=1:C=2:RESTORE:INPUT"RESONATE 100 KHZ HIGHER OR LOWER (H/
L)";HL$:IF CT>1THENFQ=QF
2026 IF HL$="L"THENFQ=FQ-.18:IFFQ<3.45THENCLS:PRINT"STUBS WILL B
E TOO LONG":GOTO 2020:ELSELPRINTTAB(42)"============   REFIGURE
FOR 100 KHZ LOWER  ============":GOTO 930
2027 IF HL$="H"THEN FQ=FQ+.18:LPRINTTAB(42)"============   REFIG
URE FOR 100KHZ HIGHER   ============":GOTO 930
2040 CLS:LPRINT"CALCULATIONS NOW COMPLETE":END
2050 REM NO FEEDERS 160-40 ONLY
2055 NF=1
2070 Q = (1005/FQ)/4
2090 FD = ((Q-J)*4)/2
2110 IF FD < 8 THEN FD = 8
2130 RETURN
2150 END
2170 LPRINT"FLATTOP","TOTAL LN","PER SD","FEEDR LN(MAX)"
2190 LPRINTSTRING$(63,45)
2210 LPRINT FL,TW,:IF(BQ=1)OR(MQ=1)LPRINTQ,FD
2215 IF LE=1LPRINT"PULL SLIGHT OVERLENGTH THROUGH TO CREATE FEED
POINT":LE=8
2230 IF CQ=1LPRINT,EL
2250 LPRINT"                ":IF MQ=1THENGOSUB4000:RETURN
2270 LPRINT"STUB LN","2 SD","2 SD"
2290 LPRINTSTRING$(40,45)
2310 IF CQ=1LPRINT,L,W:GOSUB4000:RETURN
2330 IFBQ=1LPRINT SL:GOSUB4000:RETURN
2340 LPRINT"FEEDPOINT SPACING = 2 - 4 INCHES"
2999 END:REM QUAD SCHEMATIC
3000 LPRINT"+ + + + + + + + + + + + + + + + + + + + +"
3010 LPRINT"+                                       +"
3020 LPRINT"+              (FLAT TOP)               +"
3030 LPRINT"+                                       +"
3040 LPRINT"+       ALL WIRE INCL FEEDERS           +"
3050 LPRINT"+          THHN  # 14                   +"
3060 LPRINT"+        INSULATED STRANDED             +"
3070 LPRINT"+                                       +"
3080 LPRINT"+ + + + + + + + + + + + + + + + +       +"
3090 LPRINT"                                +       +"
3100 LPRINT"          FEEDERS =======>      +       +"
3110 LPRINT"                                +       +"
3120 LPRINT"   50 OR 75 OHM COAX            +       +"
3130 LPRINT"              AND STUBS         +       +"
3132 IF(MQ=1)OR(CQ=1)THENLPRINT" FEEDPOINTS  ==========>    C
   C  <=========="
3135 IF BQ=8 THENLPRINT"                ":RETURN
3140 LPRINT"      FED AT       + * * * *  +       +  * * * * *"
3150 LPRINT"      POINTS  C    *   --->   C       C   <---   *"
3155 LPRINT"                   *                          *"
3180 LPRINT"                   *         ALL STARS        *"
3185 LPRINT"                   *         ARE DETUNING     *"
3190 LPRINT"                   *           STUBS          *"
3200 LPRINT"                  ":RETURN
3999 END
4000 LPRINT"                  ":LPRINT"*** ALL VALUES ARE GIVEN
 IN FEET":RETURN
```

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Full-Wave 80-Meter

Flat-top	Total Wire	Length/Side	Feeder Length (Max) Each
257.70	283.10	64.42	20.30

Full-Wave 40-Meter (Miniature Quad)

Flat-top	Total Wire	Length/Side	Feeder Length (Max) Each
138.62	141.55	34.65	1.5

Table 1. Full-size quad dimensions for 80 and 40.

15, and 20. (It better have, with the total cost of the beam, tower, thrust bearing, rotor, and accessories needed to use it including 190 feet of half-inch hardline tipping the 2000-dollar figure compared to about 15 dollars worth of wire and coax!)

Now came the clincher. Joe mused, "It's too bad the thing will not operate satisfactorily on all or most bands without a tuner. With all the buttons and switches at your shack, Rich, a tuner would drive you nuts."

His observation was sadly true. I have spent a great deal of time building all my "junque" behind wood panels, and my brand of operation would be greatly hampered by such an accessory. This situation was basically also true for Joe. Seems that neither of us was satisfied to just stand our equipment on desks where troubleshooting and disconnecting would be easy!

We finished that long Saturday, satisfied that this German fellow was terrific for 80 CW and 40 phone with the length cut for 3.6 MHz.

Joe called me a day or so later and in sorrow explained to me that he could not make the full-sized quad fit his property, nor could he fit one cut for 40 as the lowest band. He asked if I could program my computer for some possible compromise, feeding it the swr and length measurements we had gathered and recorded (thanks to Joe's insistence). It took about two weeks with usable spare time to get the TRS-80 to spit out a configured compromise for Joe's application—a quad 24' × 32', with 40-meter phone as the lowest usable subband. This quad had two "stubs" draping down 13 feet each, meeting the RG-59/U coax. Further possible complications were that we could raise this only 15 feet high on one end, 8 feet high on the other, and one leg ran parallel and nearly against his rain gutter! Guess what? With minimum stub trimming, the thing not only took off at 1.2:1 on 7250 and was under 2:1 on 10 and 15 as well, but it was just a bit of a problem on 20.

In the next few weeks, we both piled up reports and pleas to send the specs of the monster to numerous hams who indicated their wishes to own a copy of this performer. Joe's "little cutie" was super on 40, intriguing on 15, and devilish on 10. He had wonderful reports from far-away places that he could hardly copy on his dipoles. While my family and I were vacationing last summer in New England, I had daily contacts to home with five of my local friends, including Joe. On 40, he constantly had the superior signal to the other four on our rig in Dad's motor home. My folks and my wife, all hams as well, noted this. Dad made an appointment to have a quad erected at his place when we got home!

One day, near the end of the summer, Joe again nailed me with a challenge which turned out to be a personal vendetta: "Do you think we could allband this thing? You don't need it with your beam, but it would be a blessing to a lot of hams who are short on real estate and whose pocketbooks cannot justify a tuner."

The antenna was so good that I could not resist trying. It is clearly the best that I have ever had the pleasure of using.

I decided that maybe one could feed the square, or "flat-top," of the antenna with different lengths of so-called stub wire much the same as several inverted-vees are fed with the same coax, assuming the rf would travel the least-resistance pathway. This is not only untrue with the quad configuration, but it also fouled up everything about the antenna, complete with lowered receive capability. I was giving it up as a bad job when Joe saved the day. He made some tests that concluded that the stub principle of my computer's origin could be the key, that coupling to these stubs in a capacitive way might yield compromise pathways to rf, and that its being a voltage-fed antenna just might allow this effect to work. I altered the computer program to make theoretical tests on the possibility. It projected swr's indicating that we might have something.

The bottom line turns out to be the following: Erect the quad with 3.9-MHz math in the flat-top. The total amount of wire should be figured for 3.55 and the difference between these two plus 60% of this difference shall drape down like tuned feeders, being spaced with a 2-3-inch constant. Altering this constant spacing does definitely affect the necessary feeder length—we chose this particular constant.

Table 1 presents construction data to those who want to stop reading right now and go to work!

As depicted in Table 1, the full-sized antenna will perform superbly from 160 through 40 meters, on 10 meters, and is flat on 2! The trick (for me, at least) was what we did next. Joe and I installed a pair of auxiliary wires from the coaxial feedpoint, and free-hanging on their other ends. With a little care in pruning these, 20 and 15 meters finally came into use for my touchy solid-state finals, showing about 1.6:1 swr or better on the phone subbands. This is alterable to suit your desires. These "free stubs" are about 40% of the length of the tuned feeders for starters, or about 8.2 feet. I must add that this is only valid on the 80-meter quad; the lengths for these free stubs would be too short for capacitive value on the miniature or configured versions.

So, now over three years later, we have ended up with four distinct design versions:

1) A tribander for 160 through 40 meters (being a half wave on 160; it radiates well).

2) An allbander, including 2 meters, with appropriate stubs.

3) A mini-quad, full wave on 40 meters, fine on 15 and 10, and still flat on 2.

4) A configured version, rectangular in shape, showing some directivity, good on 40, 20, 10, and 2. The configured version, I believe, will be of interest to many because of the relatively small amount of real estate necessary for its use. For a compromised setup, it seems to operate without compromise!

The general methodology for the configured, smaller-than-formula antenna, is: L=1005/F, where the length of antenna in feet is equal to 1005 divided by the frequency in MHz

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(this, of course, is the standard formula for the total length of any quad). FL = 2W + 2L; in this, the flat-top is equal to twice the available width plus twice the available length. ST = (L − FL)/2; each stub is equal to the total formula length minus the available flat-top length, the difference divided by two.

The configured quad should have the minimum parameter that either two parallel legs should be no shorter than 50% the length of the longer two. We also found that any measurements of available space should be at least 50% the formula length for any one side of the lowest band chosen, no matter which version is used. I must point out here that all of the above are solidly flat across the whole of that dreaded 11-meter band!

There is no negativity intended to those wonderful-when-needed boxes, the tuners, but all the above findings were recorded without their use. We did hook my tuner to the wire, just to make sure one could be used, and had no trouble at all. One note: The miniature quad (a full wave on 40 meters) should be calculated the same way as the big one; use 7.1 (twice the 3.55 constant) in the loop formula. Then redo with 7.25, and subtract the two. The difference cut in half makes each feeder to be spaced 2-3 inches and fed with coax.

Computer Program

My program is in the hands of many hams who have asked Joe and me to please send to them the specs on the quad. Almost every query was as a result of response to these hams having been on the receiving end of our "Americanized quad." I must admit that I delight in having a ham's visit to my shack topped off with a printout for him of his choice of quad versions.

It is for this reason that I included the program with this article. It could be shortened for simplicity, but then only the programmer could enjoy or even use it. With this, one can run off the math for various frequencies and note the resonance changes on the other bands. I have allowed for the computer to demonstrate how the swr should change if one should alter the detuning stub length for 20-15-10 operational changes.

In case there is no printer available, the program could be typed over, changing all LPRINT commands to PRINT; however, line 140 contains POKEs to select either mode almost as comfortably. Line 35 ensures the normal condition. The math in various lines calculates values for each antenna version, as outlined previously. The decimal comparisons in lines 1110 through 1550 were made from proportions calculated from our swr findings; lines 1630 through 1730 contain eleven frequencies from each band tested for swr prediction. Lines 1810 through 1990 allow heading printing; lines 2170 through 2330 print findings under correct categories depending on user selection of antenna type; and 3000 through 3200 print out the schematic of each possible design.

Neither Joe nor I profess to be any sort of expert on antenna theory. We have, however, built many antennas, and to date, we feel that this is the best and probably least-expensive antenna one can use. It has performed well on the DX bands and superlatively on the rest. Has anyone got the real estate and equipment to stick up a full-wave on top band?■

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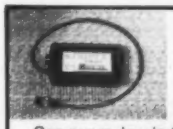

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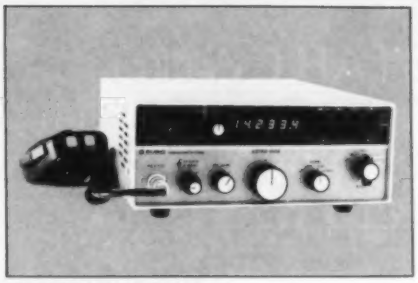

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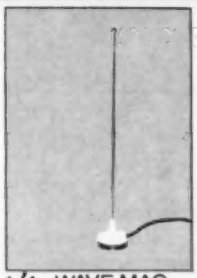

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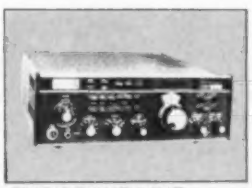

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LLIST	DIM	GOTO*	INT
RUN	DATA	ON..GOTO*	RND
NEW	READ	ON..GOSUB*	SGN
ATR	RESTORE	IF..THEN*	CHR
	LET*	INPUT	USER
	FOR	PRINT*	TAB
	NEXT	LPRINT*	
	STOP	PATCH	
	GOSUB*	RETURN	

*Flags statements that may be used in the direct mode (No statement numbers)

Math Operators

- – Unary negation
- * Multiplication
- / Division
- + Addition
- – Subtraction

Relational Operators

- = Equal
- <> NOT equal
- < Less than
- > Greater than
- <= Less than or Equal
- >= Greater than or Equal

Line Numbers may be from 0001 to 9999

Variables	Simple Variables	Single alphabetic or Single alphabetic and a single digit
		Single alphabetic
	Arrays:	One or two dimensions
Backspace	Backspace	
Line delete	Delete	
Panic Button	Should bring back to the READY mode regardless of what the BASIC user program is doing.	

NOTE: With the addition of this total package all of the programs contained in applications module one are internal to the ATR-6800 except SSTV. In other words, you do not need an external module in the communications mode. "Basic" and Message Editor programs are, however, provided in a new applications module. (A separate SSTV module is available for $49.95 if ordered with this package.)

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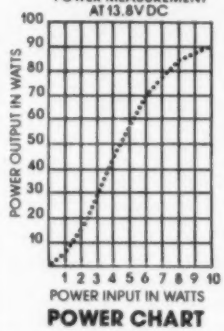

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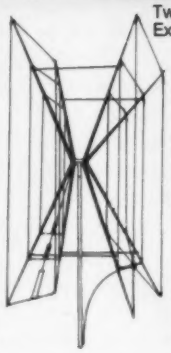

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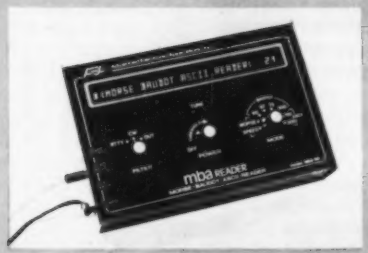

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SATELLITES

PHASE IIIB PROGRESSES

The long-awaited launch of the Phase IIIB amateur satellite is now set for July 6, 1982. It has been nearly two years since the original Phase III satellite was destroyed when its Ariane launch vehicle exploded shortly after liftoff from the European Space Agency (ESA) launch facility in French Guiana. Supporters of the amateur space program are hoping fervently for a more successful outcome this time.

The first four launches of Ariane were test flights, and the AMSAT Phase IIIA bird had the misfortune of riding aboard the ill-fated second test launch. Since then, Ariance has flown successfully twice, and is now considered to be an operational launch vehicle. The Phase IIIB satellite will be a passenger on Ariane's second operational flight.

The Phase IIIB satellite is quite similar to Phase IIIA, but there are some differences. The on-board rocket motor, which is used to boost the satellite from its initial low orbit into a high elliptical orbit, is now a liquid-fuel device, as opposed to the solid-fuel design on IIIA. An additional communications transponder is included as well, a so-called "Mode X" transponder, with an uplink in the 23-cm band and a downlink at 70 cm. Phase IIIB will also carry a Mode B transponder, with its 70-cm uplink and 2-meter downlink.

The high orbit of Phase IIIB has several benefits. For much of the world, the satellite will be above the horizon, and available for communication, for hours at a time, rather than for 20-25 minutes as in the case of previous amateur birds. Tracking will also be simplified, since the satellite will appear to move quite slowly across the sky. The major disadvantage of the high orbit is that reliable communications through Phase IIIB will require a higher effective radiated power (erp) than the low-orbit satellites required. Estimates range from 500-1,000 Watts for Mode B to 1,000-2,000 Watts erp for Mode X. These levels can be achieved with reasonable amounts of power and high gain antennas.

AMSAT Satellite Report (ASR), a biweekly publication, is now running a "Phase III Countdown" article series to keep those interested in amateur satellites apprised of the events leading up to the Phase IIIB launch. Subscriptions to *ASR* are $18 a year. Write to *Satellite Report*, 221 Long Swamp Road, Wolcott CT 06716.

THE RADIO SPUTNIKS

The communications transponder aboard RS-5 has been active, at least part of the time, since early February. RS-5 shares its communications passband with RS-6, and it appears that the RS-5 transponder is turned on only when there is no possibility of interference with RS-6.

Satellite watchers should pay special attention to RS-3 and RS-4 on May 1. This is May Day, a time the Soviets often select for unusual events of all sorts. It is thought that this might be the occasion for a burst of activity from these previously quiet satellites.

QRM ON 10

The launching of the six RS satellites, and the resulting increase in Mode A activity, has focused attention on the problem of interference in the upper reaches of the 10-meter band. The downlink passbands of the RS transponders, beacons, and robots, as well as the Mode A downlink of OSCAR 8, all lie in the region between 29.3 and 29.5 MHz. This area is also populated with other amateur signals, and everything from FM to CW can be heard on the high end of 10 when the band is open.

For satellite users, the problem lies in the fact that satellite communications often occur at very low signal levels. The presence of a strong terrestrial signal in the wrong place can wreak havoc with satellite work. It is quite likely that the non-satellite users of this spectrum do not even realize that there is a problem. Fortunately, 10 meters is a large band; a few polite words of explanation can often result in a station moving out of the area of the band used by the satellites.

It should be remembered that no group of users has exclusive rights to any part of the amateur bands. On the high end of 10, a little mutual cooperation will go a long way.

RADIO MOSCOW

For an unusual source of RS information, try tuning your shortwave receiver to Radio Moscow's DX program. This five-minute show airs several times a week, but was recently heard on Sunday from 1925-1930 UTC. A typical program includes listener reports of interesting shortwave broadcasts heard, technical information on antennas and receivers, and sometimes a special feature, such as news of the RS satellites.

Radio Moscow broadcasts to North America on many frequencies, as any 40-meter op will attest. The 31-meter transmissions on 9710 and 9685 kHz seem particularly strong during the afternoon.

Thanks to *AMSAT Satellite Report* for portions of the above. — WB8BTH.

OSCAR 8 Orbital Information for May

Orbit #	Date	Time (GMT)	Eq. Crossing (Degrees West)
21170	1	0032:13	78.6
21184	2	0036:43	79.8
21198	3	0041:14	81.0
21212	4	0045:45	82.1
21226	5	0050:16	83.3
21240	6	0054:47	84.4
21254	7	0059:18	85.6
21268	8	0103:50	86.8
21282	9	0108:21	87.9
21296	10	0112:52	89.1
21310	11	0117:23	90.2
21324	12	0121:54	91.4
21338	13	0126:25	92.6
21352	14	0130:56	93.7
21366	15	0135:27	94.9
21380	16	0139:58	96.0
21393	17	0001:10	71.4
21407	18	0005:49	72.6
21421	19	0010:20	73.7
21435	20	0014:51	74.9
21449	21	0019:22	76.0
21463	22	0023:53	77.2
21477	23	0028:24	78.4
21491	24	0032:55	79.5
21505	25	0037:27	80.7
21519	26	0041:58	81.8
21533	27	0046:29	83.0
21547	28	0051:00	84.2
21561	29	0055:31	85.3
21575	30	0100:02	86.5
21589	31	0104:33	87.6

OSCAR 8 Orbital Information for June

Orbit #	Date	Time (GMT)	Eq. Crossing (Degrees West)
21603	1	0109:04	88.8
21617	2	0113:35	90.0
21631	3	0118:06	91.1
21645	4	0122:37	92.3
21659	5	0127:08	93.4
21673	6	0131:39	94.6
21687	7	0136:10	95.8
21701	8	0140:41	96.9
21714	9	0002:01	72.3
21728	10	0006:32	73.5
21742	11	0011:04	74.6
21756	12	0015:35	75.8
21770	13	0020:06	76.9
21784	14	0024:37	78.1
21798	15	0029:08	79.3
21812	16	0033:39	80.4
21826	17	0038:10	81.6
21840	18	0042:41	82.7
21854	19	0047:12	83.9
21868	20	0051:43	85.1
21882	21	0056:14	86.2
21896	22	0100:45	87.4
21910	23	0105:16	88.5
21924	24	0109:47	89.7
21938	25	0114:18	90.9
21952	26	0118:49	92.0
21966	27	0123:20	93.2
21980	28	0127:51	94.3
21994	29	0132:22	95.5
22008	30	0136:53	96.7

SOCIAL EVENTS

NEENAH WI
MAY 1

The 3F Amateur Radio Club Swapfest will be held on Saturday, May 1, 1982, from 8:00 am to 3:00 pm, at the Labor Temple, Neenah WI. Admission is $1.50 in advance and $2.00 at the door. Tables are $1.50 in advance and $2.00 at the door. There will be prizes, food and beverages, an auction, and a semi-formal banquet on Saturday evening. The banquet cost is $8.00 per person to advance ticket holders and no banquet tickets will be available at the swapfest. Talk-in on 146.16/146.76 and 146.52. For tickets contact Mark Michel W9OP, 339 Naymut Street, Menasha WI 54952, or phone (414)-722-4034.

OWEGO NY
MAY 1

The Southern Tier Amateur Radio Clubs will hold their 23rd annual hamfest on Saturday, May 1, 1982, from 9:00 am until 5:00 pm at the Owego Treadway, Owego NY. Take NY Rte. 17 to exit 65. Outside flea market spaces will be available. Features will include dealer displays, technical and non-technical talks, door prizes, and refreshments. Talk-in on 146.22/.82 and 146.16/.76. For additional information, contact Craig England KF2X, RD 1, Box 144, Vestal NY 13850.

MEADVILLE PA
MAY 1

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be held on May 1, 1982, beginning at 8:00 am at Crawford County Fairgrounds, Meadville PA. Admission is $3.00 and children under 12 will be admitted free. Inside display area is $5.00 (bring your own tables) and outside car space is $2.00. There will be refreshments, and commercial displays are welcome. Talk-in on .04/.64, .81/.21, and .63/.03. For more details, write CARS, Attn: Hamfest Committee, PO Box 653, Meadville PA 16335.

LYNNFIELD MA
MAY 1

The Quannapowitt Radio Association (QRA) will hold an indoor/outdoor hamfest on Saturday, May 1, 1982, from 9:00 am to 4:00 pm at South Hall Fire Station, corner of Salem and Summer Streets, Lynnfield MA. Admission is $1.00 at the door. Reserved tables are $5.00; at the hamfest, $7.00. Food will be available. Talk-in on 146.19/.79 or .52. For additional details, write Dave Meldrum KA1M1, 28 Cedar Lane, North Andover MA 01845.

GREENVILLE SC
MAY 1-2

The Blue Ridge Amateur Radio Society will hold the Greenville Hamfest on May 1-2, 1982, at the American Legion Fairgrounds, White Horse Road, ½ mile north of I-85, Greenville SC. Admission will be $3.00 at the gate (no advance sales). Talk-in on 146.01/.61 and 223.46/224.06. For further information, write Gary D. Whidy, Hamfest Chairman, Rte. 6, Box 268, Travelers Rest SC 29690.

GRAY TN
MAY 1-2

The Bristol Amateur Radio Club, the Johnson City Amateur Radio Association, and the Kingsport Amateur Radio Club will hold their second annual Tri-Cities Hamfest on May 1-2, 1982, from 9:00 am to 5:00 pm on Saturday and from 8:00 am to 4:00 pm on Sunday at the Appalachian Fairgrounds, north of Johnson City (off Highway 137), Gray TN. The dealer space charge is $25.00 in advance and $30.00 at the door for the weekend for a 10'x12' space. The dealer charge also includes security and admission for five employees. There are approximately 40 RV spaces with complete hookups renting for $5.00 per night inside the fairgrounds. Motels are available nearby. Dealers can set up anytime after Friday noon or after 6:00 am Saturday and Sunday. Further information can be obtained by writing Mary S. Biggs, Secretary-Treasurer, Tri-Cities Hamfest, PO Box 3682 CRS, Johnson City TN 37601, or phoning (615)-928-1818 after 5:30 pm and on weekends.

YAKIMA WA
MAY 1-2

The Yakima Amateur Radio Club, W7AQ, will hold its annual hamfest on May 1-2, 1982, at the Ahtanum Youth Activities Park, Yakima WA. There will be overnight camping Friday and Saturday night at the site, ham equipment dealers, a raffle, and a free swap and shop. Doors open at 9:00 am on Saturday with lunch available on both days. Breakfast begins at 6:00 am on Sunday. No admission will be charged. Talk-in on 147.84/.24 and 146.52. For more information, contact David Pankey N7BRB, 512 South 7th Street, Yakima WA 98901.

STIRLING NJ
MAY 2

The Tri-County Radio Association will hold its annual hamfest/flea market on Sunday, May 2, 1982, from 9:00 am to 4:00 pm, at the Passaic Township Youth Center, Valley Road, Stirling NJ. Donations are $2.50 each and tables are $6.00. Hot food and refreshments will be available and door prizes will include an Icom IC-2AT. Talk-in on 147.855/.255 or 146.52. For additional information, write Jack Sammarco, 2062 Emerson Avenue, Union NJ 07083, or call Herb Klawunn W2CHA at (201)-647-3461.

CENTRALIA IL
MAY 2

The Centralia Wireless Association, Inc., will hold its annual hamfest on Sunday, May 2, 1982, at the Kaskaskia College gymnasium, 3 miles northwest of Centralia IL. Admission is free and there will be no charge for flea market and exhibit space. Doors will open at 7:00 am for setups and a limited number of tables will be provided on a first come, first serve basis. Food, refreshments, and plenty of free parking will be available. Various prizes will be given away throughout the day; the main prizes will be awarded at 2:00 pm. Prize tickets are $1.00 each or 6 for $5.00. They may be purchased in advance by sending an SASE to Centralia Wireless Association, Inc., Hamfest Tickets, PO Box 1166, Centralia IL 62801. Talk-in on 147.27/.87 and 146.52. For further information, contact Bud King WB9QEG at (618)-532-6606, Lou Hodges W9IL at (618)-533-4724, or write to CWA, Inc., at the above address.

DORCHESTER MA
MAY 2

The New England Amateur TV (NEAT) Group, Inc., will sponsor a general amateur radio outdoor flea market on May 2, 1982, rain or shine, at Freeport Hall, Dorchester MA, just off the SE Expressway. Admission is $1.00. There will be 300 selling spaces in a secured area and sellers' admission is $7.00 at the gate. Plenty of parking will be available. Talk-in on 145.29 and .52.

ROSEVILLE CA
MAY 2

The North Hills Radio Club of Sacramento will hold its 10th annual ham swap on Sunday, May 2, 1982, from 9:00 am to 3:00 pm, at the Placer County Fairgrounds, Highway 65, north of Roseville CA. Admission and door prize tickets are free. There will be dealer displays, a large flea market area, and a grand prize of a Kenwood TR-7850 2-meter synthesized 40-Watt transceiver. Features will include club auctions, food and refreshments, and raffles. Talk-in on 144.59/145.19 and 223.18/224.78 (K6IS).

EAST HARTFORD CT
MAY 2

The Pioneer Valley Radio Association will hold the fifth annual PVRA Flea Market on Sunday, May 2, 1982, at the George Penny High School, East Hartford CT (exit 91 off I-86) from 10:00 am to 4:00 pm. The admission donation is $1.00 and tables are $8.50. For an advance table reservation or further information, contact Arnie DePascale K1NFE, PO Drawer M, Plainville CT 06062.

FEEDING HILLS MA
MAY 7

The Hampden County Radio Association will hold its annual flea market on May 7, 1982, at 8:00 pm at the Feeding Hills Congregational Church, junction of Rtes. 57 and 187, Feeding Hills MA. Talk-in on 146.34/.94. For more information, contact Larry Langevin K1GXU at (413)-583-8236.

BREWSTER NY
MAY 8

The Putnam Emergency Amateur Repeater League (PEARL) will hold its first annual indoor hamfest on Saturday, May 8, 1982, from 9:00 am to 4:00 pm at the JFK Elementary School, Foggintown Road (off Farm-to-Market Road from Rte. 312), Brewster NY. General admission is $.50 and exhibitors' admission is $2.00. Talk-in on 145.135/144.535 and .52. For advance table registration and information, contact Frank Konecnik WB2PTP, RD1-224C, Carmel NY 10512.

CEDARBURG WI
MAY 8

The Ozaukee Radio Club will sponsor its 4th annual swapfest on Saturday, May 8, 1982, at the Circle B Recreation Center, located on Highway 60, Cedarburg WI (20 miles north of Milwaukee) from 8:00 to 1:00 pm. Admission is $2.00 in advance, $3.00 at the door. All 8-foot tables are $3.00. Door prizes, food, and refreshments will be featured. Sellers will be admitted at 7:00 am for table setup. For further information or tickets, send an SASE to Ozaukee Radio Club, PO Box 13, Port Washington WI. 53074.

DULUTH MN
MAY 8

The Arrowhead Radio Amateur Club will hold its annual swapfest on Saturday, May 8, 1982, at the First United Methodist Church, 230 East Skyline Parkway, Duluth MN. Admission is $2.00 in advance or $2.50 at the door. Door prizes will include an Icom 2AT. A raffle will also be held and prizes will include a Regency D100 programmable scanner and a portable B/W TV. Raffle ticket donations are $1.00 or six for $5.00. Reserved 4-foot tables are $3.00 in advance and $3.50 at the door. Doors will be open from 10:00 am to 3:00 pm. There will be plenty of food, free parking, and hourly prize drawings. Talk-in on

Continued on page 104

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TUFTS ELECTRONICS

61 Lowell Rd., Hudson, N.H. 03051

9-6 Daily (603) 883-5005 12-5 Sunday

....TOWERS....ROTORS....ANTENNAS....COAX....HF XCVRS.... Over 1000 different amateur radio items are listed on these two pages, and most of them are in stock ! Open SEVEN DAYS every week and NO SALES TAX in New Hampshire. You'll find that our DISCOUNT PRICES are hard to beat and our FRIENDLY SERVICE is second to none. We're only 30 mins from Rte 128 in BOSTON via Rte 3, and only 45 Mins from LOGAN International Airport in Boston, If you cannot visit us then try our FAST mail order service. Most mail and PHONE orders are shipped in one day. Send $1 for our ENLARGED CATALOG, free with orders.

DISCOUNTS - FREE CATALOG - EXPORTS - PACKAGES

ALLIANCE MFG

	REGULAR	SALE
HD-73 DUAL SPEED AMATEUR ROTOR RETIRED	170.95	109.95
U-100 TV ROTOR (AZ/EL MOTOR FOR DISCAV)	90.95	65.95

ALPHA AMPS

	REGULAR	SALE
76A TWO 8874 TUBES 1.5KW+ HEAVY DUTY AMPL	1900.00	1699.00
76PA THREE 8874 TUBES 1.5KW+ INPUT HEAVY DUTY AMPL	2395.00	2199.00
76CA THREE 8874 TUBES 6TRN HD AMPL	3495.00	2999.00
77DX 2+ KW 144 CARRIED HD WIDEBAND TUNING	3495.00	2999.00
78 THREE 8874 TUBES AND HD WIDEBAND TUNING	3495.00	2999.00
77SX ONE 8877 TUBE 5KW PEP INPUT NO TUBE LIMIT	5850.00	4699.00

AMPHENOL CONNECTORS

	REGULAR	SALE
PL-259-S 5 PCS PL-259 FOR RG8U/11/213 ETC		4.50
UG-175-10 10 PCS ADAPTER FOR PL-259 FOR RG-58/U		3.50
UG-176-10 10 PCS ADAPTER FOR PL-259 FOR RG8X(M)		5.50
83-1Z (PL258) DOUBLE FEMALE SO-239		2.50
83-6TF PL-259 TO PL-259 DOUBLE MALE		3.50
83-1F (UG363) RG213 TO RG220 BULKHEAD MOUNT		5.50
83-1AM TURNAU CLBOW SO-239 TO PL-259		5.50
83-1T (UG88) 100 PL-259 TO TNC RG-213		5.50
31-5PS 5 PCS SO-239 PANEL RECEPTACLES		5.00
83-670/S 5 PCS SO-239 DOUBLE HOLE MOUNT RECPT		7.50
83-1SP (UG175) 5 PCS RG58/U PL259 FOR RG-58U		3.50
31-12/S 5 PCS UG260/U BNC PLUG FOR RG-59U		10.50
31-6ST (UG491) BNC FEMALE PANEL RECEPTACLES		3.50
31-236/S 5 PCS UG492/U BNC DOUBLE HOLE RECPT		6.50
83-6U (UG201) N MALE FOR RG8U		3.50
83-6J (UG27B) N FEMALE FOR RG-8U		3.50
83-6JA (UG58A/U) N FEMALE RECEPTACLE		3.50
83-6JS (UG29B) N DOUBLE FEMALE		5.50
83-6T (UG57B) N TEE FEMALE JACKS		6.50
83-6U (UG28B) N MALE TO TNC MALE		3.50
83-1U (UG57B) N TEE ONE MALE TO TWO FEMALE		13.50
31-238 UG914/U BNC RECEPTACLE		3.50
31-219 UG914B) BNC DOUBLE FEMALE		5.50
31-9 (UG306) BNC ELBOW MALE TO FEMALE		5.50
31-8 (UG274) BNC TEE ONE MALE TO TWO FEMALE		7.50
31-7 (UG273) BNC MALE TO N PLUG ADAPTER		5.50
31-217 BNC PLUG TO K JACK ADAPTER		6.50
2PCS (UG255) BNC MALE TO UHF		3.50
31-216 (UG201) BNC FEMALE TO N MALE ADAPTER		5.50
31-206 BNC FEMALE TO PL-259 ADAPTER		3.50
83-6U (UG18A) N MALE TO SO-239 ADAPTER		5.50
83-6UJ (UG83) N FEMALE TO PL-259		5.50
83-1U MO-259 TO MOTOROLA OR RCA PLUG		2.50

ANTECH ANTENNAS

	REGULAR	SALE
HT-1 ALL BAND MOBILE ANTENNA 80-10 METERS	139.95	122.50

ASTRON CORP

	REGULAR	SALE
RS-35 AMP LEVEL REGULATED SUPPLY	45.95	42.50
RS-35A 7 AMP (25W) REGULATED POWER SUPPLY	69.95	62.50
RS-12A 12 AMP LEVEL REGULATED POWER SUPPLY	89.95	82.50
RS-20A 20 AMP LEVEL REGULATED POWER SUPPLY	119.95	109.95
RS-20M 20 AMP LEVEL REGULATED POWER METERED	129.95	119.95
RS-35A 35 AMP LEVEL REGULATED POWER SUPPLY	169.95	154.95
RS-35M 35 AMP LEVEL REGULATED POWER METERED	189.95	169.95
RS-50A 50 AMP REGULATED 12VDC SUPPLY	253.95	229.95
RS-50M 50 AMP REGULATED 12VDC METERED	283.95	249.95
VS-35M 35 AMP SUPPLY WITH DUAL METERS	222.95	199.50
RM-35A 35 AMP SOLID STATE INVERTED TO 117VAC 250W	75.95	68.50

B&W LOADS AND WATTMETERS

	REGULAR	SALE
375 DUMMY LOAD WATTMETER TO 300MHZ 1500WATTS	225.95	213.50
334A DUMMY LOAD WATTMETER TO 300MHZ 1000WATTS	195.00	182.50
335 DUMMY LOAD WATTMETER TO 300MHZ 2500WATTS	325.00	305.00
304 DUMMY LOAD TO 300 MHZ 1500 WATTS	99.50	99.50
370-10 10 POSITION ANTENNA SWITCH 10 KVOLT 250MHZ	89.95	84.50
361-C ELECTRONIC T/R SWITCH 115VAC	99.50	99.50

B&W COAX SWITCHES

	REGULAR	SALE
325 SIX POSITION AUTO-GROUND UNUSED POS	22.50	22.50
326 SIX POSITION SIXTH POS GROUNDS ALL POS	22.50	22.50
327 110 VAC AMP CHANGEOVER RELAY	25.00	23.50
390 5 POSITION AUTO-GROUNDING	22.75	22.50
390A 5 POS AUTO-GROUND UNUSED POS	22.75	22.50
391 7 POS WITH AUTO-GROUND UNUSED POS	27.50	25.50
392 2 POLE 2 POSITION	22.00	22.00
395 6 POS WITH AUTO-GROUND ALL UNUSED POS	27.50	25.50

BENCHER

	REGULAR	SALE
BC-1Sw 2 BAND SSB CHANNEL INCLUDES AIRCRAFT	599.95	599.00
BC-2Sw 2 BAND SSB CHANNEL W/SEARCH & HOLD	649.95	629.00
BC-210SL 4 BAND SSB CHANNEL W/SEARCH & HOLD	549.95	529.00
BC-210SWR 4 BAND 16 CHANNEL W/SEARCH & HOLD	449.00	429.00

BENCHER

	REGULAR	SALE
BY-1 PADDLE PADDLE HEAVY BLACK BASE	42.95	39.50
BY-2 DELUXE PADDLE KEY HEAVY CHROME BASE	52.95	49.50
BY-2B DELUXE 3.5-3Q KEY		47.50
BY-2B DELUXE 14-20 KEY WITH MEM FOR 2" DOTS		49.50
AF-1 AUDIO OSCILLATOR	69.95	64.50
AP-1 ACCESSORY POWER SUPPLY 12VDC		9.50

BIRD ELECTRONICS

	REGULAR	SALE
843 WATT METER SPECIFY 50-220 OR TYPE N	151.00	144.50
4431 WATTMETER W/VSWR/PEP & AM MTR	295.00	279.00
2-30 RMS ELEMENTS SPECIFY POWER AND FREQ	38.00	37.50
2-50-1000 RMS ELEMENTS SPECIFY POWER AND FREQUENCY	41.00	39.50
CC-1 CARRYING CASE FOR 643	29.00	28.00
1-30 RMS 25W WATTMETER	99.00	94.50
43A2 VHF AMATEUR WATTMETER	99.00	89.50

Power Range	Frequency Bands (MHz) 3 to 30	25 to 60	50 to 250	200 to 500	400 to 1000
5 watts	5A	5C	5D	5E	
10 watts	10A	10B	10C	10D	10E
25 watts	25A	25B	25C	25D	25E
50 watts	50A	50B	50C	50D	50E
100 watts	100A	100B	100C	100D	100E
250 watts	250A	250B	250C	250D	250E
500 watts	500A	500B	500C	500D	500E
1000 watts	1000A	1000B	1000C	1000D	1000E
2500 watts	2500A				
5000 watts	5000A				

cushcraft CORPORATION

CUSHCRAFT 50/220/430 ANTENNAS

	REGULAR	SALE
2208 220-223 MHZ 17 ELEMENT BEAM	99.95	79.50
617-SS 6 ELEMENT 17 WAVELENGTH BEAM 6 METERS	109.95	102.50
A220-7 220-225 MHZ 7 ELEMENT BEAM	34.95	32.50
A220-11 220-225 MHZ 11 ELEMENT BEAM	44.95	39.50
A449-6 449 MHZ 6 ELEMENT BEAM	32.95	28.50
A449-11 449 MHZ 11 ELEMENT BEAM	44.95	37.50
HR2-220B 220-225 MHZ RINGO RANGER	49.95	41.50
HR2-450B 450-470 MHZ RINGO RANGER	49.95	41.50
A432-20T 432 MHZ 20 ELEMENT TWIST BEAM	99.95	90.50
450-3 450 MHZ 3 ELEMENT BEAM	19.95	18.50
450-5 50 MHZ 5 ELEMENT BEAM	29.95	26.50
450-9 50 MHZ 9 ELEMENT BEAM	44.95	39.50
A420-11 432 MHZ 11 ELEMENT BEAM	44.95	37.50
432-6 432 MHZ 6 ELEMENT OSCAR	34.95	32.50
432-SS 432 MHZ 17 ELEMENT COLINEAR	89.95	81.50
432-16 432 MHZ 16 ELEMENT BEAM	69.95	62.50
1296-31 1296 MHZ 31 ELEMENT BEAM	69.95	62.50
1296-55 55 ELEMENT BIG BITE BEAM		89.50
1296-SS 1296 MHZ 17 ELEMENT COLINEAR	69 695-11	59.50
621-SS STR 617 WITH 2 A620-11		89.50
A620-11 620 MHZ 11 ELEMENT BEAM	27.95	25.50
A651-SS STR 617 FOR 2 A650-6 OR A650-10	29.95	26.50
A651-10 STR 617 FOR 2 A650-10		34.50
A650-SS STR 617 FOR 4 A650-11	139.95	115.95
A650-VPS STR 617 WITH VERTICAL FOR 2 A650-11		59.50
A650-VPX STR 617 VERTICAL FOR 2 A650-6 OR 10		34.50
220-2MX 220 MHZ RINGO RANGER	20.95	18.50
450-2MX 220 MHZ RINGO RANGER	20.95	18.50
A70-20T 70MHZ 20 ELEMENT BEAM	99.95	89.50
A70-220 70MHZ LPF MOUNT 220 MODELS ANT		29.50
A70-450 70MHZ LPF MOUNT 450 MODELS ANT		29.50
A50-220 220 MHZ RINGO	21.95	19.50
A50-450 450 MHZ RINGO		19.50
220-2MCP 220 MHZ 2 METER 2 ELEMENT BEAM	21.95	19.50
450-4MCP 450MHZ 70 CM 4 ELEMENT BEAM		19.50
220-222 ELEMENTS FOR 220		34.50
10-220 10 METERS 3 ELEMENT BEAM	169.95	139.95
15-220 15 METERS 3 ELEMENT BEAM		99.50
20-220 20 METERS 3 ELEMENT BEAM		99.50
10-333 10 METERS 3 ELEMENT BEAM		99.50

CUSHCRAFT 2 METER ANTENNAS

	REGULAR	SALE
32-19 140-154 MHZ 19 ELEMENT	109.95	93.50
214B 144-148 MHZ 14 ELEMENT BEAM	69.95	59.50
214FB 144.5-148 MHZ 14 ELEMENT BEAM	69.95	75.00
A2WO-7 2 METER 7 ELEMENT OMNI	34.95	29.50
A147-4 4 ELEMENT END FOUNT BEAM	29.95	26.50
A147-11 11 ELEMENT BEAM	44.95	38.50
A147-20T 20 ELEMENT 10 WATT 10 MILE FM 144/147	79.95	69.50
A147-20TS 20 ELEMENT 10 WATT HARDWARE AND HARNESS	139.95	113.50
A144-10T 144 MHZ 10 ELEMENT BEAM	59.95	49.50
A144-10T 144MHZ 10 ELEMENT TWIST ANTENNA	69.95	59.50
A144-20T 144 MHZ 20 ELEMENT TWIST ANTENNA	89.95	79.50
A147-HD HTO 617 FOR 2 TWIST ANTENNAS		29.95
A144-11 144 MHZ 11 ELEMENT BEAM	34.95	29.50
A144-11 144 MHZ 11 ELEMENT BEAM	49.95	39.50
A144-11S 144 MHZ 11 ELEMENT BEAM	49.95	39.50
2M-10B 1 TO 1 BALUN FOR 50-120		29.50
2M-SS STR 617 FOR 4 214B	249.95	199.95
2MX-10B STR 617 FOR 2 214-120	199.95	159.50
2MX-SS STR 617 FOR 4 214-120		179.95
PS-4 POWER DIVIDER 4 ASSEMBLY		34.50
PS-2 POWER DIVIDER FOR 2 144/147		19.95
A14-VPX 60 ABOVE VERTICAL		34.50
A147-VPX 60 ABOVE VERTICAL		34.50
A147-VPS STR 617 FOR 2 A147-11		34.50
A17-2M STR 617 FOR 2 188-7		29.95
A2M-10B STR 617 FOR 4 A10-11	179.95	149.95

DAIWA

	REGULAR	SALE
CNA-2002 AUTOMATIC ANT TUNER 80-10 MTRS 2kw PEP	699.95	619.95
CNW-518 PANEL VERSION OF CNA-2002		599.50
CN-520 SWR/PWR METER CROSS NEEDLES 140-4 MTRS		79.95
CN-540 SWR/PWR METER CROSS NEEDLES 440-450 MTRS		79.50
NF-306 AUDIO NOTCH FILTER		79.50
NF-308 AUDIO NOISE FILTER		79.50
NF-310 AUDIO NOISE/HUM SUPPRESSOR		79.50
CN-620 160-2 MTR SWR/WATT METER DUAL NEEDLE	155.75	134.95
CN-630 160-2 MTR SWR/WATT METER DUAL NEEDLE	155.75	134.95
CN-720D CN-630B W/LARGE METER BOTH 80 TO 2 MTR	219.75	179.95
CN-720I CN-630B W/LARGE METER BOTH 80 TO 2 MTR	219.75	179.95
CN-901 6 POS COAX SWITCH 50 OHM ISOLATION	89.95	71.50
NF-660 RF SPEECH PROC METERED GAIN AND OUT CNTL	179.95	143.50

CORNELL - DUBILIER ROTORS

	REGULAR	SALE
CD-45 6.5 SQ FT 40MO LOAD IN TOWER INSTALL	115.75	102.50
MRM-1X 10 SQ FT 40MO LOAD MED MAST INSTALL	205.75	182.50
725 35 SQ FT 40MO LOAD HEAVY TOWER INSTALL	315.75	265.00
514X725 COMBO ROTOR 514X AND 725		399.00
514A7-1S LOWER MAST SUPPORT (MAST-TO-TOP)		32.50

COBRA CB

	REGULAR	SALE
142CL DIGITAL LED CHANNEL DISPLAY	89.95	74.50
142DL DIGITAL/LED CHANNEL DISPLAY	109.95	94.50
292CL DIGITAL/ANALOG-DELTA TUNE/CLOCK	174.95	149.50
146GTL 40-CHANNEL VOICE LOCK	209.95	179.50
148GTL AM/SSB/DYNAMIC-ANL/NOISE BLANKER	249.95	208.50
148GTL-DX AM/SSB/DYNAMIC-ANL/NOISE BLANKER	249.95	208.50
2000FTL AM/SSB BASE W/MODULATION ANALYZER	349.95	299.95
2000GTL AM/SSB BASE W/MODULATION ANALYZER	449.95	381.50
4PRO 2M 25W 10-CH W/SYNTHESIZED STEREO	329.95	279.50
5PRO 2M 25W 10-CH W/SYNTHESIZED SUBMERSIBLE	329.95	279.50
440TC 440 MHZ 25W 10 CH	299.95	254.95
CB450 6 POST CB1 CABLE FOR 440TC		29.95
CB450S 6 POST CB1 CABLE FOR 440TC		29.95
DC CABLE REPLACEMENT DC CABLE FOR COBRA MODELS		2.50
MC-1 MOBILE MOUNTING BRACKET		4.50

COAX CABLES

	REGULAR	SALE
500 3 FT RG-58U W/PL-259 BOTH ENDS		3.50
505 5 FT RG-58U W/PL-259 BOTH ENDS		3.75
510 10 FT RG-58U W/PL-259 BOTH ENDS		4.50
520 20 FT RG-58U W/PL-259 BOTH ENDS		5.50
525 25 FT RG-58U W/PL-259 BOTH ENDS		6.50
575 75 FT RG-58U W/PL-259 BOTH ENDS		15.50
5100 100 FT RG-58U W/PL-259 BOTH ENDS		19.50
883 3 FT RG-8U W/PL-259 BOTH ENDS		5.50
885 5 FT RG-8U W/PL-259 BOTH ENDS		6.50
8810 10 FT RG-8U W/PL-259 BOTH ENDS		8.50
8825 25 FT RG-8U W/PL-259 BOTH ENDS		15.50
8850 50 FT RG-8U W/PL-259 BOTH ENDS		25.50
8100 100 FT RG-8U W/PL-259 BOTH ENDS		34.50
8E-100 100 FT 8 CON MOTOR CABLE -SPECIFY LENGTH		34.50
8CT-100A 100 FT 8 COND ROTOR CABLE HEAVY		49.50
8E-100 100 FT 8 COND ROTOR CABLE (100 FT END UP)		49.50
8218-100 BELDEN 8214 HI-QUALITY RG-8U		69.50
8MC-100 100 FT RG-8U COPPER BRAID		44.50
8Q-8U-100 100 FT 8U FOAM COPPER BRAID HIGH QUALITY		49.50
8X-213-100 50 OHM CCNX 100 FT LENGTH HI QUALITY		49.50
450-100 450 OHM ENSULATION LINE 1 W 100 FT OR UP		14.50

DRAKE

	REGULAR	SALE
MS-7 MOBILE SPEAKER FOR TR-7	109.95	99.50
MS-7A MOBILE SPEAKER FOR TR-7A	109.95	99.50
MS-7D SPEECH PROCESSOR FOR TR-7	159.95	149.50
CW-7S ELECTRONIC KEYER		89.50
P-7S POWER PATCH		39.50
MS-7 MOBILE SPEAKER FOR TR-7		99.50
SL-300 300 HZ CW FILTER		59.50
SL-500 500 HZ CW FILTER		59.50
SL-1800 1800 HZ SSTV FILTER		59.50
SL-4000 4000 HZ AM FILTER		59.50
SL-6000 6000 HZ AM FILTER		59.50
RJS-7 RJS PANEL PROGRAM BOARD FOR TR-7		45.50
MMK-7 MEMORY MODULE KIT FOR TR-7		29.50
FA-7 FAN FOR TR-7/RS-7/DL-1000		29.50
RS-7 REMOTE RS FOR TR-7	149.95	139.50
MS-7 SPEAKER FOR T-4,5W		49.50
MMC-7 MEMORY CARTRIDGE FOR TR-7		39.50
7072 DYNAMIC MOBILE MIC FOR TR-7		79.50
7077 DYNAMIC DESK MIC FOR TR-7		89.50
7037 TR-7/R-7 SERVICE KIT		59.50
7804 SERVICE MANUAL FOR TR-7		35.50
7805 SERVICE MANUAL FOR R-7		35.50
R-7/TR-7 CABLE INTERFACE KIT		29.50
MC-3K MOBILE MOUNTER FOR TC-3		90.50
MP-7SU REAR PANEL AC POWER PROTECTOR		29.50
RS-75 2000 160-10 METER TUNER	299.95	290.00
RS-75B 2000 160-10 MTR W/ WWV	349.95	335.00
B-1000 4/1 GALLON FOR TUNERS		99.50
DSR-2 DIGITAL SPEECH RECORDER	449.95	399.50
SW-7 2000 FM KIT WATTMETER	129.95	127.50
SW-7A 2000 FM WATTMETER		179.50
SL-1000 1000 HZ CW FILTER 1-1000		59.50
PS-7 POWER SUPPLY FOR TR-7 110/220V	299.00	277.00
PS-7B POWER SUPPLY FOR TR-7 110/220V	199.00	189.50
L-7 160-15 25W AMP & PS	1019.00	984.50
L-4B 160-15 1.5KW AMP & PS	1599.00	1499.00
L-500Z TUBE (2 NEEDED FOR L-7) 15 PER L-7Q		120.50
7800 DIGITAL/ANALOG CONVERSION TERMINAL	1695.00	1595.00
TR-5 TRANSCEIVER 160-10 MTRS SOLID STATE	1040.00	992.50
MS-5 MOBILE SPEAKER FOR TR-5		99.50
TR-930 9" BLACK AND WHITE VIDEO MONITOR		199.50
1564 SURGE SHUNT KIT FOR TR-7		24.50
DRK AUTO MARKING LCD 3 1/2 DIGIT MULTIMETER	99.95	89.50

DRAKE TV2 FILTERS

	REGULAR	SALE
LP-2 TWO KSCP AC LINE FILTR/TRANSIENT SUPPRESSOR		39.50
LP-4 4C 4KSCP AC LINE FILTR/TRANSIENT SUPPRESSOR		49.50
TV-62 100W LOW PASS FILTER FOR TRANSMITTERS		14.50
TV-300 300W LOW PASS FILTER FOR TRANSMITTERS		19.50
TV-300 300 OHM HIGH PASS FILTER FOR TV SETS		14.50
TV-75 75 OHM HIGH PASS FILTER FOR TV SETS		14.50

DRAKE TV80

	REGULAR	SALE
SSR-2A SIXTH STATION RECEIVER	695.00	645.50
SC-SSR SIXBLE CONVERSION CONN CONVERTER FOR SSR	259.00	225.50
SPK-2A SPLASH PROOF HOUSING FOR CONN CONVERTER		89.50

KANTRONICS

	REGULAR	SALE
FIELD DAY II CODE/MTTY/ASCII READER	649.95	599.50
FIELD DAY BBS SHIELDED ADDITIONAL 64K RAM	69.95	59.50
MINI-READER COMPACT MINI-READER FOR CW/RTTY/ASCII	299.95	281.00
KIBBITZER SIMPLEX CW/RTTY DUAL AUDIO FILTER	149.95	139.50
WORSTFILT WORSTLITER HIGH QUALITY AUDIO FILTER	119.95	109.50
INTERFACE HARDWARE FOR CW/RTTY/ASCII COMPUTER	199.95	179.50
MICRO-RTTY MICRO RTTY/SENDO RTTY W/WWV ON KEYER	299.95	249.00
SLICED 24 HOUR WWV TIME AND FREQ DISPLAY		99.50
HARRIOTT APPLE SOFTWARE FOR CW/RTTY/ASCII TERM		39.00
INTERFACE HARDWARE FOR HARRIOTT PROGRAM	100.00	179.50

HUSTLER

	REGULAR	SALE
2-10B THREE ELEMENT TRI-BAND BEAM 10-15-20	319.95	213.50
4-BTV 4 BAND THAT VERTICAL 10-40 METERS	179.95	99.50
5-BTV 5 BAND THAT VERTICAL 10-80 METERS	199.95	129.50
6-BTV 6 BAND THAT VERTICAL 10-80 METERS LIP ANTENNAS	89.95	79.50
CG-144 2MTR COLLINEAR ANT 1/2 WAVE 5/8 STUB	59.95	39.00
CG-220 220MHZ COLLINEAR WITH 5/8 WAVE LIP MOUNT	59.95	49.00
CGT-220 220MHZ COLLINEAR WITH TRUNK LIP MOUNT	69.95	61.00
CG-450 450MHZ COLLINEAR WITH 5/8 WAVE LIP MOUNT	69.95	61.00
CG-1440 7 DB GAIN COLLINEAR ANT FOR 2 METRS	159.95	117.50
RM-1 MOBILE COIL MOUNT 1/2 & 3/4 THREAD		19.50
RM-2 MOBILE COIL MOUNT 3/8 X 24 THREAD		19.50
RM-3 5" MAST FOR SUPER MOUNT HF ANTENNA	27.95	22.50
RM-4 10" MAST FOR SUPER MOUNT HF ANTENNA	27.95	22.50
RM-5 MOBILE COIL MOUNT		19.50
RM-6 MOBILE COIL MOUNT		19.50
RM-60 60 METER RESONATOR		19.50
RM-75 75 METER RESONATOR	40.95	34.50
RM-80 80 METER RESONATOR		34.50
RM-160 75 METER RESONATOR	40.95	34.50
RM-75 75 METER RESONATOR		34.50
RM-80 80 METER RESONATOR		21.50
RM-160 160 METER RESONATOR	40.95	34.50
SSM-1 COMMERCIAL STAINLESS STEEL BOLT & SPRING	20.95	19.50
SSM-2 COMMERCIAL STAINLESS STEEL MOUNT	21.95	19.50
SSM-3 COMMERCIAL STAINLESS STEEL SPRING	19.95	17.50

JANEL LABORATORIES

JANEL PREAMPS

	REGULAR	SALE
SSM-5 2 METER LOW NOISE AUTO/SWITCH FOR SSMRS		41.50
SSM-6 6 METER LOW NOISE AUTO/SWITCH FOR SSMRS		41.50
HM-1 2 MTR PREAMP MODULE 20dB MAX NOISE FIG		16.50
HM-6 6 MTR PREAMP MODULE 20dB MAX NOISE FIGURE		16.50
SW-RS RFI/PREAMP SW SWITCH		21.50
SW-RM RFI/PREAMP SW SWITCH		21.50
220PA 220 MHZ VERSION PREAMP AS ABOVE		21.50
432PA 432 MHZ VERSION PREAMP AS ABOVE		21.50
432PL 1 DB NOW NOISE FIG 432 MHZ GASFET BY MGFET		63.00

JW MILLER FILTERS

	REGULAR	SALE
CS-6017 250 PEP LSB PASS 7500 HARMO KIMMIC	46.00	39.50
CS-6021 2.1 KHZ BANDWIDTH LINE FILTER 8PP MAX	46.00	39.50
CS-6018 5 SECTION 6M AMATEUR 8 AMP MAX	54.00	39.50
CS-6019 5 SECTION 10 METER 8 AMP MAX	54.00	39.50
CS-6014-2 AS ABOVE 220 VDC	95.00	59.50
CS-6013-2 AS ABOVE 2000 WATTS PASS FILTER FOR TV	54.00	39.50
CS-6013-75 AS ABOVE 75/75 OHMS	54.00	39.50
CS-6013-75 AS ABOVE 500/500 OHMS	54.00	39.50

KENWOOD

TRIO-KENWOOD

	REGULAR	SALE
TS-930S 160-10 METER RIG WITH VOX IF SHIFT MARS	999.95	899.95
TS-830S 160-10 METER RIG DES DISPLAY IF SHIFT	799.95	699.50
AT-230 160-10 METER ANTENNA TUNER 200 WATTS	299.95	259.95
SPS-230 REMOTE ANALOG VFO	189.95	162.50
AT-250 160-10 METER ANTENNA TUNER WITH SELECTABLE FILTERS	399.95	349.95
AT-230 ANTENNA TUNER SWR/RF POWER METER 400 WTS	199.95	187.50
TR-1300 2 METER 1 WATT 10 CHANNEL FM TRANSCEIVER	719.95	699.95
VFO-120 REMOTE VFO FOR TR-1300	149.95	139.50
SPS-230 INSTALL FREQ CONTROLLER W/MEM FOR TS-120	149.95	139.50
SP-120 EXTERNAL SPEAKER		61.50
MB-120 MOBILE MOUNT FOR TS-120	144.95	129.50
MC-10L MOBILE BRACKET FOR TS-130		29.50
PS-20 POWER SUPPLY FOR TS-130 13.8V 20AMPS	199.95	179.50
R-5000 COMM RCVR DIGITAL DISPLAY 30KHZ-30MHZ	999.95	949.50
R-1000 COMM RCVR 150KHZ-30MHZ		699.50
TL-922A 160-10 METER LINEAR AMP 2 KW PEP	1229.95	1050.00
TL-922 160-10 METER LINEAR AMP 1 KW PEP	599.95	599.95
VB-4000 220 MC DW FILTER FOR TS-820 +800 DT		119.95
YK-88C 500 HERTZ CW FILTER		89.50
YK-88CN 270 HZ CW FILTER		89.50
YK-88SN 2.4 KHZ NARROW SSB FILTER FOR TS-820/120		89.50
MC-50 50K OHM HAND MIC		39.50
MC-55 50K OHM UP/DOWN MIC		69.95
MC-60 HI-Z IMPEDANCE DESK MIC 4 PIN PLUG		69.95
MC-80 MICROPHONE		69.95
SP-31 SPLIT SPEAKER		103.50
MB-10 VEHICLE CONVERTIBLE MOBILE CLOSH		49.50
HS-5 DELUXE HEADSET		41.50
HS-6 LIGHT WEIGHT HEADPHONES	29.95	24.50
RS-20 5A DWM W/ DUPPY LOAD 5KW PEP 30 WATTS	19.95	19.95
RS-200 100A DWM W/DUPPY LOAD 5KW PEP 30 WATTS	69.95	64.50
VOX-4 VOX-SPEECH PROCESSOR	54.95	54.50
VOX-200 VOX FILTER & CABLE	29.95	29.95
R-600 RECEIVER, COVERAGE 60KHZ	599.00	549.00
TS-130SE TS-130S WITHOUT FAN	699.95	649.95
FA-4 FAN FOR TS-130SE		19.50
MC-60A HI-LO IMPEDANCE DESK MIC 4 PIN UP/DWN		89.50

KENWOOD VHF

	REGULAR	SALE
TR-7800 2MTR FM 45 WATTS 10 MEM PRIORITY	449.95	429.95
MPS-7 AC SUPPLY FOR TR-7800 TR-8000 12VDC 7 AMP	85.00	84.50
PS-50 AC SUPPLY FOR TR-7800 TR-8000 12 AMPS	99.95	94.50
TR-9130 2 MTR MULTI-MODE 25 WATTS 10 MEM TRNSC	799.95	779.95
TR-7730 COMPACT 2 MTR FM 25 WATTS 5 MEM VOICE	399.95	379.95
TR-7730A COMPACT 2 MTR FM 25 WATTS 5 MEM W/TONES	429.95	409.95
TR-2500 2 MTR FM HAND-HELD	329.95	299.50
PB-25 NI-CD BATTERY PACK FOR 2500	49.95	44.50
PB-1 MODELS SUPPLY CHARGER FOR 2500	42.95	42.50
PB-2 NI-CD BATTERY PACK	34.95	34.50
SMC-25 SPEAKER MIC FOR 2500	29.95	26.50
SMC-30 SPEAKER MIC FOR 2500	27.95	24.50
SMC-2 BELT HOOK FOR TR-2500		4.50
SMC-3 BELT HOOK FOR TR-7730		4.50
SW-1 BATTERY CASE FOR TR-2500		9.50

KLM POWER AMPS

	REGULAR	SALE
KAS-220 2-25 WATTS 2 METERS	99.95	91.00
KAM-220 2-160 WATTS 2 METERS FM

DISCOUNT CATALOG

MOR-GAIN

HALF-SIZE FULL PERFORMANCE
Multi-Band HF Communications Antennas

MOR-GAIN HD Dipole.
* One of the length of conventional half-wave dipoles
* Multi-band, Multi-frequency
* Maximum efficiency - no traps, loading coils or stubs
* Fully assembled and pre-tuned - no measuring, no cutting
* All weather load - 1 400 AM 2.5 Kw CW or PEP SSB
* Proven performance - more than 10,000 have been delivered.
* Permit use of the full capabilities of today's 5-band sets
* One resonance for operation on all bands
* Lowest cost-highest performance antenna on the market today
* Highest performance for the Non-do as well as the Extra-Class Op

MOR-GAIN	REGULAR	SALE
40-20 MB/A 80/20 MTR DIPOLE 36 FT w/RG8/U	90.00	81.50
80-40 MB/A 80/40 x 15 MTR DIPOLE 68 FT w/RG-8/U	109.50	99.50
80-40 MB/A HT 40 ABOVE TUNED FOR NOVICE	109.50	99.50
75-40 MB/A 75/40 MTR DIPOLE 66 FT w/RG8/U	104.75	94.50
75-40 MB/A HT 40 ABOVE TUNED TO 3905	104.75	94.50
75-20 MB/A 75/40/20 MTR DIPOLE 66FT RG8/U	121.00	109.50
75-20 MB/A HT 40 ABOVE TUNED TO 3905	121.00	109.50
75-10 MB/A 75/40/20/15/10 MTR DIPOLE 66FT RG-8/U	141.00	127.00
75-10 MB/A HT 40 ABOVE TUNED TO 3905	141.00	127.00
80-10 MB/A 80/40/20/15/10 MTR DIPOLE 69 FT RG8/U	147.00	132.50
80-10 MB/A HT 40 ABOVE TUNED FOR NOVICE	147.00	132.50

J.W. Miller BELL INDUSTRIES

J.W. MILLER	REGULAR	SALE
AT-1000 2.5 KW AUTO ANT TNR 2-30MHz PWR/SWR MTR	673.00	599.00
CNB-1001 500W AUTO ANT TNR 80-10MTRS PWR,SWR MTR	449.00	399.00
CN-6200 160/2 TNG MTRS DUAL NEEDLE SWR/PWR MTR	159.75	134.50
CN-7200 LARGE METER FACE VERSION OF ABOVE	218.75	175.00
CN-630 160-450 MHZ DUAL NEEDLE SWR/PWR METER	183.75	147.00
CN-2011 2 FOR CD016, BN 2.5KW 500 MHZ	20.00	23.00
CB-401 4 POSITION COAX SWITCH 4K ABOVE	09.25	08.00

LARSEN ANTENNAS	REGULAR	SALE
LM-MM-102 2 MTR 5/8 MAGNETIC MOUNT		46.50
LM-150 TRUNK LIP S/B 2 METER ANT		46.50
LM-150K 3/4 INCH HOLE MOUNT 2 MTR 5/8 ANT		33.00
LM-MM-220 MAGNETIC MOUNT 1/4 WAVE FOR 144/450/220		19.50
LM-MM-220 220 MAGNETIC MOUNT 5/8 ANT		46.50
LM-220 TRUNK LIP MOUNT 5/8 220 ANT		46.50
LM-220K 3/4 INCH HOLE MOUNT 5/8 ANT FOR 220		33.00
LM-SM 3/4 IN HOLE MNT 1/4 WAVE FOR 144/220/450		16.50
LM-MM-450 450 MHZ MAGNETIC MT GAIN ANT		46.50
LM-450 TRUNK LIP MOUNT GAIN ANT FOR 450		46.50
LM-450K 3/4 IN HOLE MOUNT GAIN ANT FOR 450		33.00
LM-MM MAGNETIC BASE FOR LM MOUNT ANTENNAS		16.50
LM-G QUARTER WAVE WHIP FOR VHF/UHF FITS LM MT		3.50
LM-J 3/4 IN HOLE MOUNT KIT FOR LM ANTENNAS		7.50
SNAP REPLACEMENT WHIP FOR LM-150 OR LM-220		5.50
LM-HC BUTTON CLAMP MOUNT FOR LM ANTENNAS		23.50
LM-150/220 ETC COIL ONLY (WHIP NOT INCLUDED)		23.50
LM-450 COIL AND WHIP ASSEMBLY		29.50

LARSEN QUICK MOUNT	REGULAR	SALE
QM-100 HI-QUALITY TWO-WAY RADIO GLASS MOUNT	36.00	34.00
QM-1000 RADIO PORTION OF MOUNT ONLY		19.50
QM-100V VEHICLE PORTION OF MOUNT ONLY		17.50
QM-GLOCK KEY LOCK SYSTEM FOR QM-100		6.50
QM-102 PROVIDES TWO ADDITIONAL CONTACTS		6.50

BOOKS	REGULAR	SALE
UNITED STATES CALLBOOK 1982 OVER 400000 LISTINGS		18.50
FOREIGN CALLBOOK 1982 OVER 360000 DX LISTINGS		17.50
RADIO AMATEURS HANDBOOK 1982 BY ARRL		9.50
WORLD RADIO-TV HANDBOOK 1982 WORLDWIDE DIRECTORY		16.50
RADIO HANDBOOK 1982 BY BILL ORR		24.50
ALL ABOUT CUBICAL QUAD ANTENNAS BY BILL ORR		5.50
BEAM ANTENNA HANDBOOK BY BILL ORR		5.00
NEWTONS SHORTWAVE RECEPTION FOR DUMMIES		9.95
VHF HANDBOOK FOR RADIO AMATEURS BY BILL ORR		4.50
COMPUTER AIDED DESIGN OF RADIO FREQUENCY CIRCUITS BY ORR		4.50
THE RADIO AMATEUR ANTENNA HANDBOOK BY BILL ORR		4.50
SUPERLOW COST HOME ANTENNAS FOR RADIO AMATEURS		4.50
INTERFERENCE HANDBOOK BY BILL ORR		8.00
ARRL ANTENNA BOOK		6.00
ARRL RADIO STATION MANUAL		5.50
ARRL UNDERSTANDING AMATEUR RADIO		3.50
ARRL FM REPEATERS		5.50
ARRL OPERATING MANUAL		5.50
ARRL BASIC BOOK OF HAM RADIO		4.50
ARRL ELECTRONICS DATA BOOK		4.50
ARRL SINGLE SIDEBAND		4.50
ARRL HINTS AND KINKS FOR THE RADIO AMATEUR		4.50
ARRL A COURSE IN RADIO FUNDAMENTALS		6.00
ARRL ANTENNA ANTHOLOGY		4.50
ARRL LICENSING MANUAL		3.50
ARRL RADIO FREQUENCY INTERFERENCE		4.50
ARRL NOVICE CLASS		3.50
ARRL WEEKEND PROJECTS		3.50
ARRL ANTENNA/SYSTEM Q&A BOOK		3.50
ARRL SOLID STATE DESIGN		7.50
ARRL TUNE IN THE WORLD WITH HAM RADIO		4.50
ARRL TECHNICIAN/GENERAL Q&A BOOK		3.50
ARRL EXTRA Q&A BOOK		3.50
ARRL CODE KIT (CASSETTE)		8.00
ARRL WORLD MAP		4.50
FINN, EARN EXTRA CLASS BY DICK SMITH		9.00
FINN, EARN ADVANCED CLASS BY DICK SMITH		9.00
FINN, EARN GENERAL CLASS BY DICK SMITH		9.00
AMECO NOVICE CLASS		4.50
AMECO COMMERCIAL RADIO OPERATOR THEORY COURSE		7.50
AMECO AMATEUR RADIO THEORY COURSE/NOVICE OPERATORS		4.50
BAND-AIDS REFERENCE DATA FOR AMATEUR OPERATORS		4.50
WAYNE GREEN 5 WORDS PER MINUTE CODE TAPE		4.50
WAYNE GREEN 13 WORDS PER MINUTE CODE TAPE		4.50
WAYNE GREEN 13 WORDS PER MINUTE CODE TAPE		4.50
WAYNE GREEN 20 WORDS PER MINUTE CODE TAPE		4.50
WAYNE GREEN 20 WORDS PER MINUTE CODE TAPE		4.50
WAYNE GREEN RTTY HANDBOOK		6.50
WAYNE GREEN COMPUTER SYSTEMS		6.50
WAYNE GREEN AUDIO FREQUENCY TESTER		6.50
WAYNE GREEN RADIO FREQUENCY TESTER		6.50
WAYNE GREEN IC TEST EQUIPMENT		6.50
WAYNE GREEN CHALLENGER OF 160		6.50
WAYNE GREEN CONTEST COMPANION		6.50
WAYNE GREEN POWER SUPPLY HANDBOOK		6.50
WAYNE GREEN WEATHER SATELLITE HANDBOOK		6.50
WAYNE GREEN SHORTWAVE RECEIVER CONSTRUCTION		7.50
WAYNE GREEN PROPAGATION WIZARDS HANDBOOK		6.50
WAYNE GREEN SERVICE PROCEDURES		6.50

3-TBA Tri-Band Beam
10 - 15 - 20 METER
Fixed Station Antenna

Engineering performance and Hustler's tradition of outstanding quality is yours in the Hustler 3-TBA tri-band beam for 10, 15, 20 meters.
Improved design featuring tri-tuned element length and unique dual resonance hub-Q traps reduce wind loading and overall weight while allowing an exceptionally wide bandwidth.
Specially developed beta match for precision tuning on all three bands and static drain off. Oversized boom to element mounting and heavy duty construction throughout assures reliable operation regardless of the weather.

- Lowest SWR at resonance
- Impedance 50 ohms
- Bandwidth at 1% broadband 650 KHz on 10, 450 KHz on 15 and 200 KHz on 20.
- 8db gain
- 25db front to back ratio
- Maximum power - legal limit
- Longest element - 23 ft 2 inches
- Boom Length - 14 feet 8 inches
- Turning radius - 13 feet
- Weight - 40 lbs

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TUFTS ELECTRONICS — **SAVE** — LIMITED SUPPLY FREIGHT EXTRA

WM. M. NYE COMPANY

WACOM DUPLEXERS	REGULAR	SALE
WP-639 2 METERS 35c WATTS 4.5"DIAMETERS 8000 10DL	$29.00	$99.50
WP-602 AS ABOVE FOR 220MHz BOTH INCLUDE CABLES	$29.00	$99.50

NYE VIKING	REGULAR	SALE
MASTER KEY CW KEY W/ HEAVY BASE NAVY ARMS AND CABLE		34.50
310-003 STANDARD CW KEY W/ SWITCH		12.50
312-003 BRASS PLATED CW KEY W/ SWITCH		13.50
320-003 NICKEL PLATED HEAVY BUTT CW KEY W/SW		14.50
321-003 CHROME PLATED HEAVY BUTT KEY W/SW		22.50
322-003 CHROME PLATED KEY W/SWITCH		15.50
404-002 MORSE MATCHER SET W/KEY		22.50
404-1 DUAL MORSE MATCHER SET W/KEY		39.50
500-003 CHROME-PLATED BASE		36.50
044-005 W-GRID PHONE PATCH WITH SPEAKER		39.50
500-1 HANDY HELPER W/SQUELCH PADDLE 110VAC/9VDC	105.00	94.50
500-001 AUTOMATIC BAR MATTHETER	99.00	89.50
500-002 LOG PAGE FOR 7-30 PAD 25W	24.50	22.50

NYE VIKING TUNING	REGULAR	SALE
MB II -01 3KW BALUN SWR/WATTMETER METER MOTOR INDUCTOR 3TB,01		395.00
MB II -02 AS ABOVE WITHOUT BALUN	3000.00	397.50
MB II BALUN KIT		99.00
2102 MIC FOR SONAR		39.50
382 REMOTE VFO FOR 2KW	199.95	179.95
382 REMOTE VFO FOR 5KW	199.95	184.50
2102 MIC FOR SONAR		39.50
645 ULTRASTIC DUAL PADDLE KEYED		69.50
677 STAND FOR PADDLE KEYED		19.50
3984 NOTCH CW FILTER FOR AMERAMAT		99.00
4900-1 MECHANICAL FILTER 2.1KHz	3495.00	2999.00
2DP 2 KW AMPLIFIER TUNED 3-30MHz 813SSB input	2495.00	2295.00

RECORD-A-CALL	REGULAR	SALE
AUTO 60A AUTOMATIC PHONE ANSWERING	149.95	134.50
VOX 70A AS ABOVE WITH VOX UNLIMITED MSG CAPACITY	199.95	179.50
REMOTE 80A ALL ABOVE PLUS REMOTE PLAYBACK FOR MESSAGES	299.95	287.50
REMOTE 90A ALL ABOVE PLUS REMOTE DUPLEXING MSG CHECK-UP	349.95	311.50
DELTA ENDLESS LOOP CUTTERS TAPE 12 TO 120 SEC		6.50
ECHOM LENGTHENS INCOMING MSG THRU 30 MIN		9.50
ICOM8 AS ABOVE 60 MIN		8.50
RA-1 EXTRA REMOTE KEY FOR 60A SPECIFY FREQ		49.50

RPT ELECTRONICS	REGULAR	SALE
RPT-144 2 MTR REPEATER 25 WATTS SOLID STATE	995.00	819.00
RPT-220 220 MHZ REPEATER 25WATTS SOLID STATE	995.00	814.50
RPT-450 450 MHZ REPEATER 15WATTS SOLID STATE	199.90	965.50

ROBOT

ROBOT RESEARCH	REGULAR	SALE
660 SLOW SCAN TV CONVERTER	795.00	699.00
800 SLOW SCAN TV/KEYBOARD MEMORY CRT	995.00	879.00
SAMMY VR-4224 9 INCH B&W MONITOR	245.00	199.50
VIDEO-1000 VIDEO/TUNER COMBINA	395.00	349.50

ROHN TOWERS	REGULAR	SALE
20G 10 FT TOWER SECTION		82.50
20G-2 TOP SECTION W/SUPPORT TUBE 2 1/2" OD	82.50	42.50
20G-3 TOP SECTION W/ROTATOR MOUNTING PLATE TOP	82.50	42.50
20-3SS SHORT BASE TO MOUNT IN CONCRETE	33.95	30.50
20-4SS LONG BASE TO MOUNT IN CONCRETE	33.95	30.50
BPC-25S CONCRETE BASE PLATE	64.50	54.50
25G 10 FT TOWER SECTION W/CONCRETE BASES		164.50
1/8X12"HP PIER PIN NEEDED W/ 25G CONCRETE BASES		4.80
25-3S 10 FT TOWER SECTION W/BASE AND PLATE		164.50
BPC-25S CONCRETE BASE PLATE	64.50	54.50
HDBX-48 HEAVY DUTY BASE FOR 48" TOWER		69.50
48G-3 TOP SECTION W/ROTATOR MOUNTING PLATE		44.50
48-4GS 4 FOOT GROUND SLEEVE		19.50
48-5GS 5 FOOT GROUND SLEEVE		24.50
AP-36S ANTENNA PLATFORM 36"	87.00	74.50
AP-36SS FEEDING OF PIPES UP TO 2"	28.50	24.50
3GS GUY CABLE DIRECTION FIXTURE		6.50
3GS GUY LINE INSULATOR		6.50
25G-1 10 FT STUB, MAST 2 INCH OD	27.95	24.50
HD20G 10 FT STEEL MAST HEAVY WALL 2 DIA OD	89.50	69.50
3/16 TG 3/16 CABLE CLAMPS FOR GUY CABLE		0.99
5/16 TG 5/16 CABLE CLAMPS FOR GUY CABLE		0.99
3/8 TG 3/8 TURNBUCKLE EYE AND JAW		14.50
5/8 TG 5/8 TURNBUCKLE EYE AND JAW		14.50
25G-50FT 50 FT TOWER PACKAGE WITH HDBX48 BRACKET	410.35	399.00
25G-70FT 70 FT TOWER PACKAGE WITH GUYED	660.00	599.00
25G-1A 1 FT SECTION		12.50
25G-2A 2 FT SECTION		15.50
25G-3A 3 FT SECTION		18.50
25G-5A 5 FT SECTION		22.50
25G-10A 10 FT SECTION		32.50
25G-3SS 3 FT CONCRETE GUY ANCHORS AND SCHACKLES	39.95	33.50
25G-4SS 4 FT CONCRETE GUY ANCHORS AND SCHACKLES	49.95	42.50
25G-5SS 5 FT CONCRETE GUY ANCHORS AND SCHACKLES	59.95	49.50
HDX 30 FT TELESCOPING STEEL MAST	37.95	29.50
3GXMK GUY KIT 3 GUYS 3 LEVELS		29.50
3GXMA 3/8" X POST GROUND ROD		6.50

SHURE

SHURE PROGRAMMERS	REGULAR	SALE
SR-1 PROGRAMMER W/ALL LETTERS	60.00	49.95
SR-2 DYNAMIC AMPLIFIED MOS MIC	89.00	79.50
SR-3 CONTROLLED MAGNETIC HAND MIC DOES CBRO	64.00	49.50

SONY SHORTWAVE	REGULAR	SALE
ICF-2001 SRM COVS RCVR/DIGITAL TUN/LCD/SCAN/MEM	249.95	299.50
ICF-6800W 31 BAND/DIGITAL DISPLAY/SRM COVS RCVR	499.95	399.50
ICF-7600A 21 BAND/DIGITAL DISPLAY/SRM QUALITY RCVR	199.95	179.50
ICF-SW HIGH QUALITY SRM OR BROADCAST RECEIVER W/MW	99.95	72.50
ICF-7700 SRM COVS RCVR/DIGITAL PORTABLE W/MW	149.95	79.95
ICF-1 SONYS FINEST PORTABLE FLL SYNN COMM REC	1795.00	1595.00
ICF-6500W FM WB/MW STEREO/LIGHT WGT HEADSET	299.95	179.50

SONY WALKMANS	REGULAR	SALE
WM-1 PORT STEREO CASSETTE W/LIGHT WGT HEADSET	99.95	97.50
WM-2 ULTRA SMALL AM AUDIO PLUS AM HR PLAYBACK	179.95	157.50
WM-109 PORTABLE/CLEAR AUDIO/RECORD & PLAY	179.95	157.50
M-5000 MICRO CASETTE STEREO RECORD & PLAY/MONIT	199.95	174.50
WM-404 FM WB/MW STEREO/LIGHT WGT HEADSET	99.95	96.50

OPEN DAILY 9 - 6
SUNDAYS 12 - 5

TELEX

TELEX HEADSETS	REGULAR	SALE
340-CUPP 300 LIGHT WEIGHT BOOM MIC HEADSET W/LD DNP		89.95
PRO-CUPP 300 DUAL MUFF BOOM MIC HEADSET W/LD DNP	99.95	89.95
PS-1 FOOT SWITCH FOR PROCOMM HEADSETS		38.50
HS-1 HANDSWITCH FOR PROCOMM HEADSETS		38.50
PC-100 8-200 OHMS HEADSET		16.50
DM-400 2000 OHM HEADSET		24.50
C-1210 DUAL MUFF HEADSET 3-20 OHMS	39.70	38.50
C-1230 DUAL MUFF HEADSET 3-20 OHMS	44.95	43.50
13-7 DUAL MUFF 600 OHM HEADSET	41.00	40.50
MTC-3 LOW/HGT MAGNETIC BOOM HDST 3-20 OHM		34.50

TEN-TEC

TEN-TEC INC	REGULAR	SALE
ANNIVERSARY 200W CW 80-10 METERS	849.00	399.00
ARGOSY 525/10-80-10 METERS	699.00	619.00
ORION 1/2KW 160-10 METERS 220V	1299.00	1079.00
DELTA 525/80-160-10 220V	899.00	799.00
227 ANTENNA TUNER/SWR METER		99.00
238 ANT TUNER/ SWR METER		99.00
1147 SUPPLY 110/220VAC FOR ARGOSY	139.95	119.00
1148 SUPPLY 110/220VAC FOR ORION	199.00	169.00
1255 ANTENNA TUNER SLD STATE/SUPPLY	199.95	179.00
234 SPEECH PROCESSOR	139.95	129.00
214 ELECTRIC KEY FOR 223		39.95
2102 MIC FOR SONAR		39.50
382 REMOTE VFO FOR 2KW	199.95	179.95
382 REMOTE VFO FOR 5KW	199.95	184.50
645 ULTRASTIC DUAL PADDLE KEYED		69.50
677 STAND FOR PADDLE KEYED		19.50
3984 NOTCH CW FILTER FOR AMERAMAT		99.00
4900-1 MECHANICAL FILTER 2.1KHz	3495.00	2999.00
2DP 2 KW AMPLIFIER TUNED 3-30MHz 813SSB input	2495.00	2295.00

TRAC

TRAC ELECTRONICS	REGULAR	SALE
TE-122 CMOS ELECTRONIC KEYER	69.95	62.50
TE-133 CMOS ELECTRONIC KEYER	99.95	89.50
TE-144 DELUXE CMOS ELECTRONIC KEYER	89.95	79.50
TE-201 MESSAGE MEMORY KEYER	79.95	71.50
TE-202 MESSAGE MEMORY KEYER	99.95	89.50
TE-292 CHAMPION MESSAGE MEMORY KEYER	135.95	119.00
TE-303 TRAC ONE CMOS PROGRAMMABLE	149.95	129.00
TE-404 CW PROCESSOR AND CMOS KEYER DELUXE	169.95	149.50

TRINITY INC	REGULAR	SALE
TD-1000 1000 MC 6DIGIT .05 PPM 7 DIGIT COUNTER	199.95	149.50

VAN SCREEN ENG	REGULAR	SALE
0-80 80 METER DIPOLE 120 FT		31.50
0-40 40 METER DIPOLE 66 FT		27.50
0-20 20 METER DIPOLE 33 FT		27.00
0-15 15 METER DIPOLE 16 FT		27.00
0-10 10 METER DIPOLE 16 FT		27.00
0-8010 80 THRU 10 METER DIPOLE 90 FT		43.50
0-4010 40 THRU 10 METER FOLDED DIPOLE 135 FT		43.50
0-8040 80/40/10 METER FOLDED DIPOLE 135 FT		43.50
0-8020 80/20/15 METERS FOLDED DIPOLE 66 FT		43.50
MT-D BALUN MT-D BALUN		10.50
D-1 BALUN 2KW CONT LOAD 10W 15 SECONDS		10.50
INSULATORS 6"ST END OR CEN FORM PAIRS		6.50
CENTER INSULATORS FOR DIPOLES ETC		4.50
FORCELAIN 300 OHM INSULATORS PAIR		1.50

VIEWPLEX	REGULAR	SALE
JANBIC DELUXE CHROME PLATED JANBIC DUAL PADDLE	65.95	59.50
JANBIC STAR CHROME PLATED JANBIC DUAL PADDLE	49.95	44.50
VIDEO-KEYER DELUXE CHROME PLATED PADDLES	65.95	59.50
VIDEO-KEYER STAR CHROME PLATED PADDLE	49.95	44.50
PRESENTATION SUPER DELUXE	99.95	89.50
PRESENTATION STAR	79.95	69.50
DIGIDIAL STANDARD KEY	34.95	29.50
DIGIDIAL DLX STANDARD KEY	34.95	29.50
LIGHTING BUG STANDARD KEY	34.95	32.50
LIGHTING BUG DELUXE KEY	34.95	32.50
LED-01 CARRY CASE		39.50
NICD NICAD C CELLS		5.50
FT-2000HD 2KW 2MTR FM MOBILE SCAN KEYBRD	629.00	579.50
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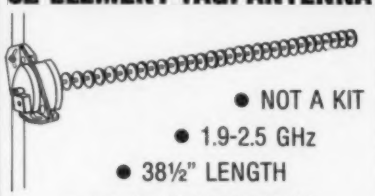

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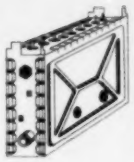

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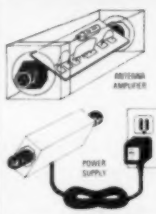

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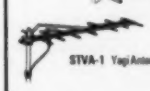

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You probably have some idea of what a Zepp antenna is. It's end-fed with open-wire line and has to be tuned using a transmatch, right? Well, Zepp is a nickname applicable to many kinds of antennas. Generally, any end-fed, half-wave antenna is a variation of the Zepp.

How did they ever come up with a name like Zepp? How does the Zepp antenna work? Can you use a Zepp, or variation, to advantage at your station?

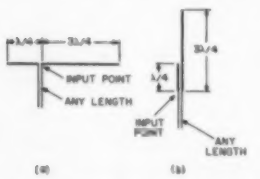

Fig. 1. At (a), a full-wave current-fed antenna. The apex angle is 180 degrees. If this antenna is folded over on itself (b), we have the classical Zepp antenna. To be a true Zepp, it should be fed directly at the input point.

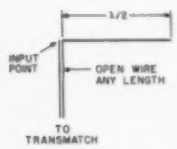

Fig. 2. The version of the Zepp most commonly used among hams. It operates at the fundamental and all harmonics.

The True Zepp

The Zepp originated from the demand for an end-fed antenna that did not require a substantial ground to work against. At first thought, this might seem like an unrealistic idea. But it can be done.

Fig. 1 shows the evolution of the Zepp, so named because it was first used as an antenna dangled from a zeppelin! A full-wave antenna has a low resistive impedance when fed at a current maximum (a). Current feed of a full-wave antenna mandates that one side be 1/4 wavelength and the other side be 3/4 wavelength. The apex angle at (a) is 180 degrees, but smaller angles will work. The antenna will work even if the apex angle is zero degrees (b). When the apex angle is zero degrees, we in fact have a half-wave piece of wire fed at the end by a quarter-wave section of parallel-wire line.

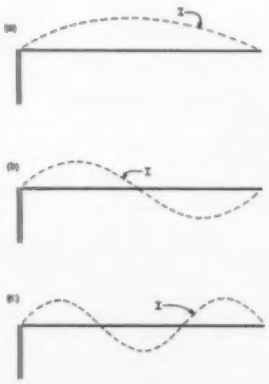

Fig. 3. Harmonic operation of the half-wave Zepp. At (a), operation on the fundamental (1/2-wave); at (b), second-harmonic operation (full-wave); at (c), third-harmonic operation (3/2-wave).

At the input point of the transmission line in Fig. 1(b), the impedance is a pure resistance of a very low value. The quarter-wave piece of line, formed from the folding over of the original full-wave antenna, acts like an impedance transformer, bringing a high impedance down to a low one.

How the Zepp Works

The radiating part of the Zepp is, of course, the half-wave part extending past the parallel-wire line. One end of the line is just left hanging. How can this work?

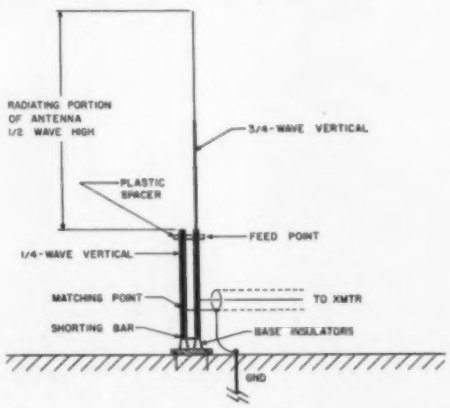

Fig. 4. The J-pole. The bottom end is shorted and the matching point adjusted for minimum swr at resonance. The height of the matching section in feet is 2.80/f, where f is given in MHz. The overall height of the structure is 700/f. This is a monoband antenna.

The voltage at the end of the half-wave radiator is applied across a theoretically infinite impedance, which causes rf current to flow along the wire. It's kind of like shaking the end of a loose clothesline to make waves up and down the rope; although we never actually *pull* on the rope, the waves nevertheless occur along its length.

In theory, the Zepp is a balanced antenna because the impedance is infinite both at the free end of the line and at the terminated end. In practice, however, there is no such thing as an infinite impedance. The impedance at the free end of the line is *extremely* high, that at the terminated end is very high. They're a little different, and this unbalances the currents in the feedline. Consequently, the line radiates to some extent. This radiation can be minimized by ensuring that the impedance at the feedpoint is a pure resistance and is as high as practicable. This requires that the radiating part of the Zepp be *exactly* a half wavelength long,[1] and also that the antenna be placed as much in the clear as possible, to maximize the impedance at the ends of the radiating length of wire.[2]

Yet, even if we dangle this contraption from a zeppelin at 40,000 feet, it won't be perfectly balanced. The feedline will invariably radiate a little energy. A properly operating Zepp is not too bad about this—it's almost as good as a center-fed antenna.

The Usual Zepp

Most hams who use a Zepp have an installation something like that shown in Fig. 2. With this kind of system, a transmatch is necessary since we don't know what the impedance will be like at the station. This kind of Zepp will work at the fundamental frequency (the band where it's 1/2 wavelength) and all harmonic frequencies. At any harmonic, the Zepp has a current node at the feedpoint. Harmonic operation of the Zepp is shown in Fig. 3.

The Zepp is somewhat temperamental about departures from its resonant frequency. Even a tiny change in frequency will move the current node away from the feedpoint—either out onto the radiating part of the antenna (frequency too high) or down into the transmission line (frequency too low). But the node at the loose end of the line cannot move. The result: line radiation! The Zepp is a narrowband antenna.

What if you have no transmatch and do not exactly feel like running out to your local ham shop and plunking down a hundred dollars or so to buy one of those fancy things they're selling nowadays? Can you still use a Zepp? Definitely. Fig. 4 shows one way to get a good match to 52- or 75-Ohm coaxial cable. Fig. 5 illustrates a second method. When the correct matching point is found, the swr is 1 at resonance.

Vertical Sans Radials

Of course, we can orient a Zepp in any direction we want. Figs. 4 and 5 show two vertical Zepp antennas. The antenna in Fig. 4 is often called a J-pole and is fairly common at VHF. But it is practical down to about 20 meters, and if you're ambitious, you might want to try building one for 40. In Fig. 5 is a method of feeding a half-wave radiator. This is definitely practical down to 40 meters. Both of these schemes constitute Zepp feed. Both of these antennas are monobanders, though, because of the matching technique used.

These antennas do not need any radial system. In both instances, the base impedance is very high and thus ground loss is kept to a minimum. Adding radials to the antenna in Fig. 5 will improve its performance, because of the gain resulting from the image signal. (This will provide the equivalent of a 2-element collinear.)

Other Zepps

A half-wave sloper may be fed at the end instead of in the center. The performance of the antenna will be the same in either case. This is shown in Fig. 6(a).

Zepp feed, because of its convenience, allows an exotic method of getting the antenna up in the air. This is shown in Fig. 6(b). The feedline should be TV-type twinlead, in order to minimize the weight, and the kite may have to be pretty big. But this idea has been used successfully on 160-meter endeavors when the wind is strong enough! One word of caution: Make sure the system is not flown

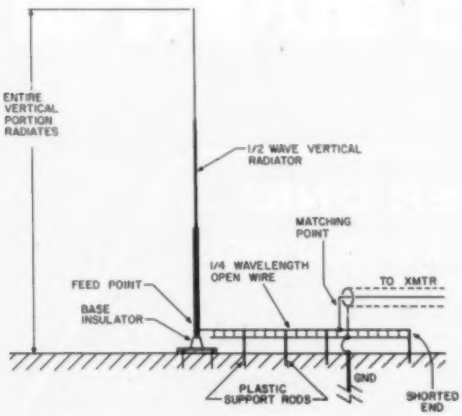

Fig. 5. Zepp feed for a half-wave vertical. The length of the open-wire matching section in feet is 275/f. (Don't use TV twinlead!) Adjustment of the matching point is required; a good starting point is 1/6 of the way from the shorted end to the antenna end of the matching section for this antenna and for the J-pole.

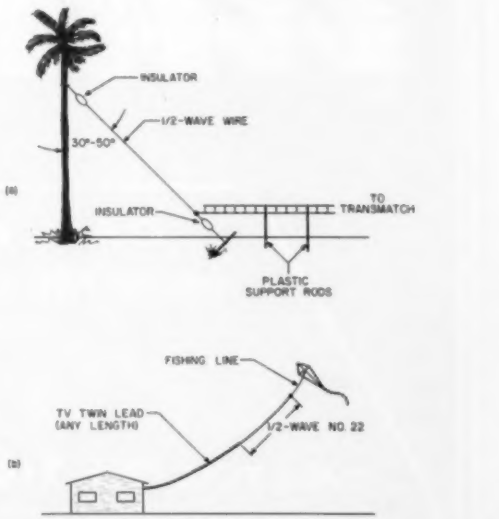

Fig. 6. At (a), end feed for a half-wave sloper. At (b), well, end feed for a half-wave sloper! These antennas will work at the fundamental and all harmonics.

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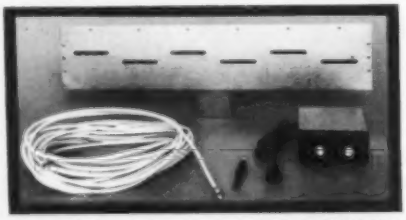

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above utility lines. Also, some guy back in the 1700s already proved that thunderstorms contain electrical energy. There is no need for you to prove it again.

Conclusion

The Zepp is versatile because end feed is physically convenient. This results in some line radiation, but if the antenna is located wisely and cut to the proper length, this problem is not serious.

The Zepp may be operated at any harmonic, although the bandwidth tends to be narrow. As a rule, consider the useful bandwidth of a Zepp to be 50 kHz either side of resonance, whether it is operated on the fundamental or a harmonic. Example: A Zepp that is a half wavelength at 7050 kHz may be used between about 7000 and 7100, 14050 and 14150, 21100 and 21200, and 28150 and 28250 kHz. (Outside these ranges, the antenna will work, but there will be significant radiation from the feedline.)

Now dig out those old porcelain insulators (you *did* save them, didn't you?) and that 300-foot roll of stranded no. 14 copper wire you bought last year at Dayton for $1.50 and thought you could never use. Hang a Zepp someplace! ■

Notes

[1] For wire antennas, use the formula: length (feet) = 468/f, where f is given in MHz, for the length of a half wave. This is only approximate and may have to be pruned, but it represents the best average value.

[2] After the antenna has been cut according to the formula, you can find its resonant frequency by using a field-strength meter placed a few feet from the feedline near the transmitter. The resonant frequency is the frequency where the field strength is minimum, indicating minimum line radiation. Then, the antenna may be pruned until its resonant frequency is as desired.

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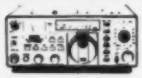

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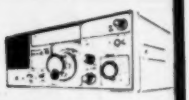

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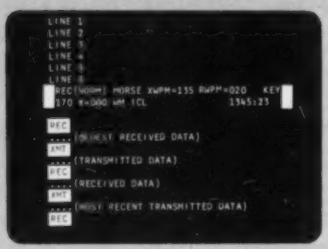

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SOCIAL EVENTS

from page 90

.34/.94. For more info, advanced reservations, or raffle tickets, send an SASE to Jerry Frederick N0BNG, 1127-104th Avenue West, Duluth MN 55808.

LUFKIN TX
MAY 14-16

The Region Four Air Force MARS will hold their annual convention on May 14-16, 1982, at the Ramada Inn, Lufkin TX. Friday night there will be an administrative meeting of all headquarters personnel and all Region Four officials, and Saturday there will be a series of programs. A banquet will be held on Saturday night. For further details, please contact Ed Langston AFA4KH, Convention Chairman, 1123 Sayers Street, Lufkin TX 75901.

CADILLAC MI
MAY 15

The 22nd annual Swap Shop & Eyeball QSO will be held on Saturday, May 15, 1982, from 8:00 am to 4:00 pm at the Wexford Civic Arena, US 131 North, Cadillac MI. Tickets are $2.50 and 8-foot tables are $4.00. There will be prizes, plenty of parking, and lunches available. Talk-in on 146.37/.97. For further information, contact Wexaukee Amateur Radio Association, PO Box 163, Cadillac MI 49601-0163.

DURHAM NC
MAY 15

The Durham FM Association will hold the annual Durhamfest on May 15, 1982, at the South Square Mall, US 15-501 south, Durham NC. Admission is $3.50 with no additional charge for tailgating or dealers' spaces. Features will include prizes and a flea market. Motels, a restaurant, facilities, tables, and power will be available. Talk-in on 147.825/.225. For more information, write Durhamfest, Box 777, Hillsborough NC 27278.

ROGERS AR
MAY 15

The Northwest Arkansas Amateur Radio Club, Inc., will hold its 2nd annual hamfest/swapmeet on Saturday, May 15, 1982, from 8:00 am to 4:00 pm at the Community Building (Old Armory), US Hwy 71, Rogers AR. Commercial exhibitors' and flea market tables and spaces are free. Doors will open at 6:00 am for setup. Main prize tickets are 3 for $5.00 or $2.00 each and prizes include a complete Kenwood station consisting of TS-130S, ac power supply, and MC-50 mike. There will also be door prizes, free parking, and programs, including MARS, DX, and Skywarn. Talk-in on 146.16/.76 or 146.52. For more information, write Mary Webb KA5HEV, PO Box 338, Prairie Grove AR 72753, or call (501)-846-2847.

BATON ROUGE LA
MAY 15-16

The Baton Rouge Amateur Radio Club will hold its annual hamfest on Saturday and Sunday, May 15-16, 1982, at Catholic High School, 855 Hearthstone Drive, Baton Rouge LA. There will be swap tables, dealers' exhibits, technical forums, and activities for the non-ham wives and children. Talk-in on .19/.79 and .52 simplex. For further information, write BRARC, PO Box 4004, Baton Rouge LA 70821.

ATHENS OH
MAY 16

The Athens County ARA annual hamfest will be held on Sunday, May 16, 1982, from 8:00 am to 4:00 pm at the Athens City Recreation Center, East State Street, Athens OH. There will be a free flea market for electronics-related items on a large paved area and some indoor space available on a first come, first served basis. Setup is at 7:00 am. Food, free parking, and several nearby restaurants will be available. Tickets are $1.00 in advance and $2.00 at the gate. Talk-in on .34/.94. For further information, send an SASE to ACARA, PO Box 72, Athens OH 45701, or phone Joe Follrod WB8DOD at (614)-797-4874.

MARSHALL MO
MAY 16

The Indian Foothills Amateur Radio Club will hold its 7th annual hamfest on May 16, 1982, at the Saline County Fairgrounds building, Marshall MO. Tickets are $2.00 each or 3 for $5.00 at the door, or 5 for $5.00 in advance. There is no charge for tables but reservations are requested. Registration will be at 8:00 am and coffee and breakfast rolls will be available from 8:00 am to 10:00 am. Lunch (all you can eat) will be at 11:30 am. The drawing will be held at 2:30 pm with a first prize of a KDK 2025 Mark II. Talk-in on .52, .28/.88, and 147.84/.24. For additional information and advance tickets, contact Jim Little KB0DA, 405 E. Rosehill, Marshall MO 65340, or call (816)-886-8583 after 5:00 pm, or K0BVB at (816)-886-2837.

EASTON MD
MAY 16

The eighth annual Easton Amateur Radio Society Hamfest will be held on May 16, 1982, rain or shine, from 8:00 am to 4:00 pm at the Easton Senior High School cafetorium, Rte. 50, just south of Easton at mile marker 66. The donation is $2.00 with an additional $2.00 for tables or tailgaters. Talk-in on .52 and 146.445/147.045. For more details, write Van Herridge WB3HGQ, Box J, St. Michaels MD 21663 or Easton Amateur Radio Society, Inc., Box 781, Easton MD 21601.

WEBSTER MA
MAY 16

The Eastern Connecticut Amateur Radio Association will hold its 8th annual flea market and auction on Sunday, May 16, 1982, starting at 9:00 am, rain or shine, at the Point Breeze Restaurant, Webster Lake, Webster MA. Admission is $1.00 and table reservations are $5.00 in advance or $7.00 at the door. Food and drinks will be available as well as free parking. The auction will be held at 1:00 pm. Talk-in on 147.885/.285 K1MUJ and 146.52. For reservations and additional information, contact Dick Spahl K1SYI, Lake Parkway, Webster MA 01570, or phone (617)-843-4420 after 7:00 pm.

WABASH IN
MAY 16

The Wabash County Amateur Radio Club will hold its annual hamfest on Sunday, May 16, 1982, from 5:00 am until 4:00 pm at the Wabash County 4-H Fairgrounds, Wabash IN. Admission will be $3.00 at the gate or $2.50 in advance. There will be plenty of food and parking available, as well as free overnight camping on Saturday. Talk-in on 147.63/.03 or 146.52. For tickets or more info, send an SASE to Dave Spangler N9ADO, 45 Grant Street, Wabash IN 46992.

EVANSVILLE IN
MAY 16

The Tristate Amateur Radio Society (TARS) will hold its annual hamfest on Sunday, May 16, 1982, beginning at 6:00 am CDT at the Vanderburgh County 4-H Center, Evansville IN. Admission is $2.00. Tables will be available in the air-conditioned indoors. An outdoor flea market will also be featured. Talk-in on 147.75/.15 and 146.19/.79. For additional information and table reservations, contact Hal Wilson WB9FNN, RR 8, Box 427B, Evansville IN 47711.

WRIGHTSTOWN PA
MAY 16

The Warminster Amateur Radio Club will hold its annual hamfest on Sunday, May 16, 1982, from 7:00 am to 3:00 pm at the Middletown Grange Fairgrounds, Wrightstown PA, near Philadelphia. Admission is $3.00 at the gate with an additional $2.00 for each 8-foot seller's space. Children and spouses will be admitted free. If pre-registered by May 1, 1982, the admission fee will be $1.00 less. Door prizes will be awarded every half hour beginning at 9:00 am. Talk-in on 147.690/.090 and 146.520. For more information, write PO Box 113, Warminster PA 18974, or call Bill Scott KA3CHB at (215)-249-0568 after 6:00 pm.

FRESNO CA
MAY 21-23

The Fresno Amateur Radio Club, Inc., will hold its 40th annual hamfest on May 21-23, 1982, at the Hacienda Inn, Clinton and Highway 99, Fresno CA. The full advance registration cost is $20.00. On Friday, activities will include registration, a golf tournament, and wine tasting; on Saturday, swap tables, commercial exhibits, a luncheon program, a CW contest, MARS meetings, a transmitter hunt, a No Host Cocktail Hour, and a banquet with speaker, Dr. Henry Richter; on Sunday, a

WPSS Breakfast. Talk-in on 146.34/.94. For advance registration or more information, contact the Fresno Amateur Radio Club, Inc., PO Box 783, Fresno CA 93712.

GORHAM ME
MAY 22

The Portland Amateur Wireless Association and the Southern Maine University Radio Club will hold their annual flea market on May 22, 1982, from 8:00 am to 4:00 pm (inside if it rains) at the Gorham ME campus. The cost is $1.00. Food will be available. Talk-in on 146.73R and 146.52S. For additional information, write John Taylor N1SD, 44 Milton Street, Portland ME 04102, or call (207)-773-2651.

GREEN BAY WI
MAY 22

The Green Bay Mike and Key Club will be holding its seventh annual swapfest on Saturday, May 22, 1982, from 8:00 am to 3:00 pm at the Norwood School, Norwood and Ninth, Green Bay WI. Admission is $1.50 in advance by May 1st, and $2.00 at the door. Table space is $2.00, and there will be one free admission for every 2 tables bought. Door prizes will be given away and food and beverages will be available. Talk-in on 147.72/.12 and 146.52. For more information, contact Bob Duescher KA9BXG, 1011 13th Avenue, Green Bay WI 54302 or phone (414)-497-7880.

WEYMOUTH MA
MAY 22

The South Shore Repeater Association will hold its ham radio/electronic/computer flea market on Saturday, May 22, 1982, at Weymouth South High School Cafeteria, 300 Pleasant Street, Weymouth MA. Admission is $1.00 for each buyer and tables are $5.00 in advance or $8.00 at the door. Doors open for sellers at 9:00 am and for buyers at 10:00 am. Food and refreshments will be available. For directions or table reservations, please contact SSRA, c/o David Newman, PO Box 447, Abington MA 02351.

KNOXVILLE TN
MAY 22-23

The 1982 ARRL Delta Division Convention and the sixteenth annual Knoxville Hamfest will be held on Memorial Day Weekend, May 22-23, 1982, at Bearden High School, Knoxville TX. Forums will be on the future of amateur radio, DXCC, the CQ 5B-WAZ program, fast-scan TV, computers and amateur radio, and the ARRL. Other activities include programs for non-ham ladies, a shuttle bus to the World's Fair, an indoor and outdoor flea market, an exhibit area, and the verifying of QSL cards by Don Search W3AZD and Bob May K4SE. Both 4-land QSL bureaus will be in attendance and cash prizes will be offered in the Ron McKean Memorial CW competition. For more information, please write Delta Division Convention, c/o Ray Adams N4BAQ, 5833 Clinton Highway, Suite 203, Knoxville TN 37921, or phone (615)-688-7771 (days) or (615)-687-5410 (nights).

HARTWELL GA
MAY 22-23

The Anderson, Hartwell, and Toccoa Amateur Radio Clubs will hold the 4th annual Lake Hartwell Hamfest on May 22-23, 1982, at the Lake Hartwell Group Camp, located on Highway 29, 4 miles north of Hartwell GA. Features include free admissions, free camping, and free flea market space. Activities include a left-footed CW contest, horseshoes, bingo, and many other activities for the whole family. Fishing, swimming, and camping are available on the site. The campground will open at 6:00 pm Friday and the main prize drawing will be held at 2:00 pm Sunday. Talk-in on 146.19/.79, 147.93/.33, and 146.895/.295. For further information, contact Ray Pettit WB4ZLG, Rte. 1 Dooley Drive, Toccoa GA 30577.

BOULDER CO
MAY 23

The Rocky Mountain VHF Society will hold the annual spring hamfest on Sunday, May 23, 1982, from 9:00 am to 3:00 pm, rain or shine, at the Boulder National Guard Armory, 4750 North Broadway, Boulder CO. The admission donation will be $2.00 per family and there is no seller's charge. The gates will open for sellers at 8:00 am and they suggest you bring your own table. The door prizes will include a synthesized FM transceiver, and extra raffle tickets will be available. In addition to the big ham swap, there will be technical demonstrations and seminars, covering topics such as fast-scan ham TV, microwaves, satellite communications, etc. Food and drink will be available. Talk-in on 146.16/.76 and 146.52. For more information, contact Richard Ferguson KA0DXM, 1150 Albion Road, Boulder CO 80303, or phone (303)-449-2871.

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Write for information.

NATCHEZ MS
MAY 23

The Old Natchez Amateur Radio Club (ONARC) will hold its hamfest on Sunday, May 23, 1982, at the Natchez Convention Center, Natchez MS. Doors will open at 8:00 am and there will be food available as well as free admission and free swap tables. Talk-in on 146.31/.91. For further information, contact S. W. Gates N5AXV, PO Box 203, Natchez MS 39120.

ISLIP LI NY
MAY 23

The Long Island Mobile Amateur Radio Club will hold the ARRL Hamfair '82 on May 23, 1982, at the Islip Speedway LI NY. General admission is $2.00 and $5.00 per car space will be charged for exhibitors. Food and refreshments will be available at the track. There will be door prizes and special prizes drawn all day from 9:00 am to 4:00 pm. Talk-in on 146.85 (a 4Z PL will extend your range into New York City). For more information, call Sid Wolin K2LJH at (516)-379-2861, or Hank Wener WB2ALW at (516)-484-4322 in the evening.

BURLINGTON KY
MAY 23

The Northern Kentucky Amateur Radio Club will hold its annual Ham-a-rama on Sunday, May 23, 1982, at the Burlington Fairgrounds, Burlington KY (off 275, Burlington-Florence exit). Individual tickets are $4.00, family tickets are $6.00, and each ticket entitles you to the major prize drawing at 4:00 pm. First prize is a Kenwood low-band TS-130S or $500, second prize is a Kenwood HC-10 station clock, and there will be a special raffle for an Icom 2AT. Features will

Continued on page 146

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D-15	15	22	26.95	22.95
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SD-40	40	45	32.95	28.95
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PD-8010	80,40,20,10,15	130	43.95	39.95
PD-4010	40,20,10,15	66	37.95	33.95
PD-8040	80,40,15	130	39.95	35.95
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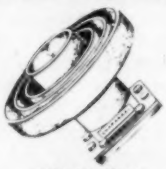

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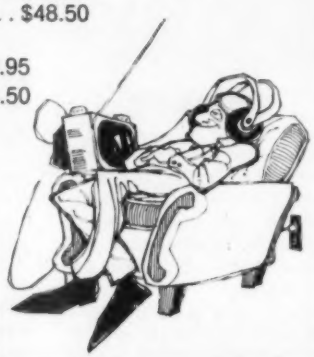

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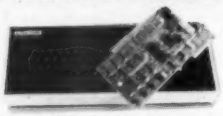

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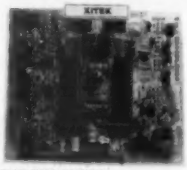

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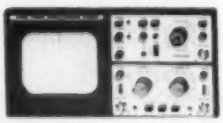

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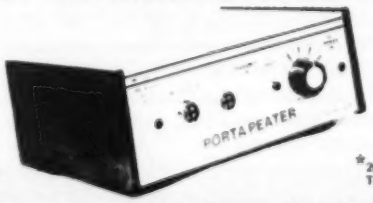

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Surviving the Unthinkable

—part I: the ham's role

Today they hauled out the last of the Civil-Defense supply cans from our office building. It wasn't much of a loss, however, because long ago the familiar drab green cans with their black lettering had been emptied of their contents. Once they had stored food, water, medical supplies, radiation-monitoring equipment, clothes, etc., enough material for several hundred people to survive for two weeks after a worldwide nuclear holocaust.

The fallout shelter sign is a symbol of protection which is now giving way to crisis relocation plans.

But the food grew rancid and the other materials deteriorated. With several reorganizations of the building, the cans constantly were reshuffled into corners until, finally, there was no other place to put them but out with the trash. Tonight they most likely grace the garage of a member of the maintenance staff who saw them as too good to discard and recovered them to use for workshop trash, discarded cuttings from his table saw, or some such refuse.

The case here is common. The once-familiar sight of fallout shelter supplies gracing the basements of public buildings has all but disappeared. Only a few of the once-common fallout shelter signs remain. Most likely, if you care to check a building displaying a shelter sign, you will find plenty of shelter and no usable supplies.

So, what would happen if our nation's 225 million people suffered an attack by a nation using nuclear warheads? Are we totally unprotected? Out of luck? Frankly, according to civil-defense planners, people heading for those old-style shelters might be out of luck, anyway. The shelters are often located in downtown areas of large metropolitan areas. With a direct hit to one of these cities, it is very likely that the shelter would provide as much protection to its occupants as no shelter at all. Cities where this problem is expected to occur are shown

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Fig. 1. The dots here represent possible high-risk areas which require crisis relocation plans.

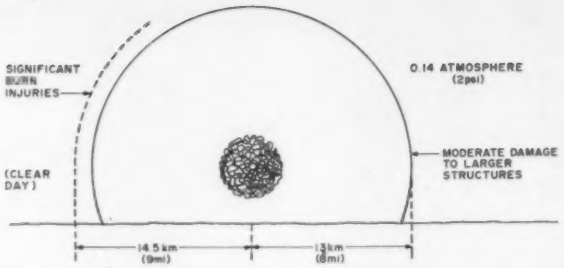

Fig. 2. Expected effects of 1-megaton air blast.

in Fig. 1, which is a map of cities most likely to receive direct hits in an all-out nuclear war.

The idea of these home cities being targets of some foreign nuclear power is not a pleasant thought. But in a world of increasing tensions, there no doubt will be an increased interest in our praying for peace, and also preparing for our own personal defense in the event our world leaders some day fail to keep the peace.

As an alternative to hiding in big-city shelters, planners suggest that it may be better to move people out of the crucial areas where devastation is most likely to occur. (Fig. 2 shows the sphere of effect for each 1-megaton device.) This plan is apparently patterned after a Russian plan discovered several years ago.

According to a recent publication of the Federal Emergency Management Agency, which now handles civil defense, the new plan is as much a negotiation plan as anything. They feel that in a game of superpower brinksmanship, where each side will see just how far the other will go before "pushing the button," the Russians would most likely evacuate their cities as a defense mechanism before launching an attack on us. Naturally, the planners feel our intelligence sources would let us know of the evacuation. At that point, we would rely on our country's availability of rapid transit and family cars to completely evacuate before the Russians do. We would then declare that since we're safe and they're not, they should back off and forget about blowing us to oblivion.

There are some good points about the plan. It is true that the United States has great versatility due to our widespread use of private cars, while the Russians cannot afford to have a car in every garage and would need to rely on trains, buses, and "marching routes" to move their people 30 to 200 miles from major cities. An illustration of their plan is shown in Fig. 3. The weather, however, complicates survival, as shown in Fig. 4.

Calculating the cold hard facts and the alternatives of attack plans, civil-defense authorities in the US figure that if the Russians attacked before evacuating, they would lose about 100 million civilians. On the other hand, if they evacuate first, they would lose a mere 20 million.

A non-classified Federal Emergency Management Agency report issued in October, 1980, states five key points about a Soviet attack strategy.

"1) The Soviets probably have sufficient blast-shelter space in hardened command posts for virtually all of the leadership elements at all levels (about 110,000 people).

2) With a few hours of warning or less, the Soviets would suffer over 100 million casualties, but a large percentage of the leadership elements probably would survive.

3) With 2 or 3 day of preparation, the Soviets would suffer less than 50 million casualties.

4) With a week (or more), they would suffer casualties in the low tens of millions.

5) Therefore, the critical decision to be made by the Soviet leaders in terms of sparing the population would be whether to evacuate cities. Only by evacuating the bulk of the urban population could they hope to achieve a marked reduction in the number of urban casualties."

The same reasoning applies to the United States. The most horrifying part of the statistics is that at the very least we're talking about tens of millions of lost lives. And that doesn't count radiation sickness, burns, exposure, starvation, etc.

The United States system was scheduled to be in place for most all cities during 1981. Under the system, planners believe that 80% of our population would survive to rebuild. Again, they do not estimate the aftereffects of such a disaster on the survivors of any nation.

Even after the plans are completed, there will be much additional work to be done: Shelters need to be constructed; managers need to be trained; tests of the system must be made, followed by evaluation of the tests and redirection based on the results of the tests.

Amateur radio is not mentioned in the FEMA publication sent to me regarding the crisis relocation plan. The response I received from an FEMA official states, "Those amateur radio operators who operate with Radio Amateur Civil Emergency Services (RACES) are still a very important part of civil preparedness. RACES licenses as such are no longer being issued by the FCC, but each RACES operator uses his own call letters. However, these persons must be recognized as part of the civil-preparedness organization in order to operate during emergencies under the auspices of RACES. Any RACES planning should be done with your own state of Iowa and the FCC."

Such planning is of little consolation to the residents of a state when they find out that nearly all of the state's (Iowa) 4,000 hams cannot operate, and the few licensed to operate the state's RACES station left the state one day ahead of a nuclear attack.

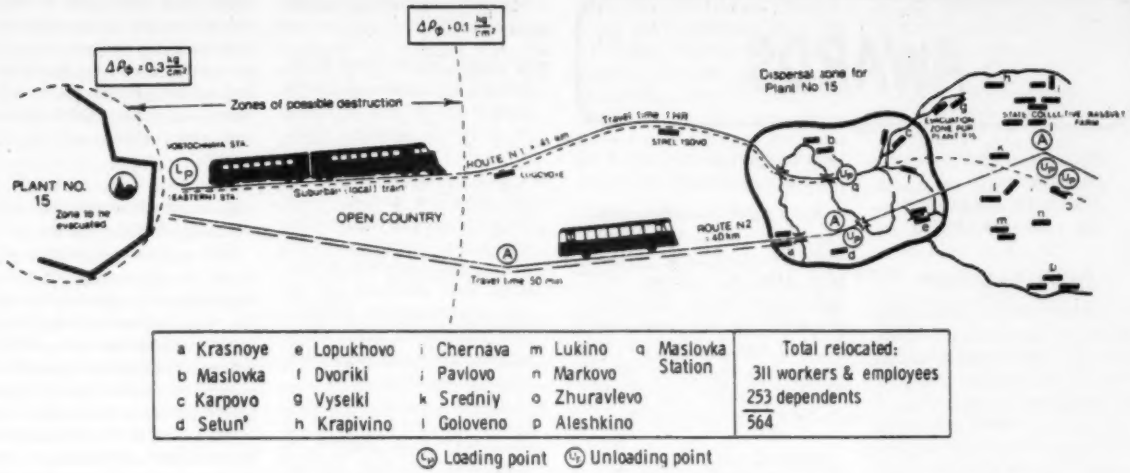

Fig. 3. According to the Federal Emergency Management Agency, this diagram shows Soviet plans for a crisis relocation program. The plan calls for dispersal of the population and daily commuting of workers to their places of employment.

By comparison, the May, 1980, issue of *73 Magazine* carried an article which described amateur activities when about 300,000 people came to Des Moines, Iowa, for an afternoon visit with Pope John Paul II. More than 150 local and statewide amateur radio operators provided excellent health and welfare services that day. The ratio of ham operators to population was about one amateur station for every 2,000 people. A substantially greater ratio was provided in areas where the sick and invalids were.

The situation in Des Moines was perhaps the best possible test of a crisis relocation program anywhere in the world since planners considered the notion of relocating hundreds of thousands of people. It was a complex program which was not easily undertaken. But on the specific point of supply of amateur radio operators, if the same ratio of amateur radio stations to population were applied to a national crisis-relocation program, *one out of every three* amateur radio stations in this country would need to be on the air in some assigned duty all the way from two meters through 160 meters. CW, FM, and SSB, in hundreds of orderly, planned, and tested networks, would be needed.

Fig. 4. This is one of many possible distributions of fallout from a nuclear attack on the United States. The actual distribution would, of course, depend on the location and number of actual strikes and weather conditions.

It is extremely unlikely that the present RACES system could come close to meeting the needs. As of December, 1979, there were only 610 officially licensed RACES stations on the FCC's books. We would need no less than 112,000 dedicated patriotic and very brave volunteers and their equipment.

The time is definitely here for amateurs to approach their local civil-defense authorities and the FCC to have this now-sophisticated service available on a widespread basis to every interested amateur radio operator in the event of a national emergency. Amateur radio is the only service which can provide a most-reliable communications system under severe circumstances when, for example, the entire telephone system would be rendered totally useless, merely because major switching locations would no longer exist!

Ham radio operators should be encouraged to improve their Morse-code capabilities, because under such strenuous situations, when even an amateur system may reach its peak in traffic-handling capabilities, every cycle of bandwidth of spectrum space is vital to the proper completion of the task. Currently, only CW operation can offer a bandwidth of just a few hundred cycles.

Right now, none of us, in our wildest dreams, can imagine how horrifying the world would be after a nuclear war. Our surviving population would need all the possible assistance that could be mustered, including medical supplies, food, and shelter, to name only a few. The existence of the top-notch amateur system like the one we now have could be the single most important item and could provide the key to our success.

In part II of this article, I will provide some details on just what can be done at each of our ham stations to lessen the danger to our communications systems. Some methods are simple, others incredibly expensive, but all of us can do something. ■

Acknowledgement

Figs. 1 through 3 are from *US Crisis Relocation Planning*, Federal Emergency Management Agency, 1980.

AWARDS

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AWARD DIRECTORY

Countless letters and phone calls have been received regarding a proposed award directory, supposedly being sponsored by this magazine. To set the record straight and to avoid any further confusion, allow me to say that such a *73* publication just does not exist. That, of course, does not mean one will not be available in the distant future!

To attempt such an endeavor, the compiling of precise and up-to-date information becomes paramount and obviously the most difficult task. Unfortunately, too often, the author of such a publication has to be at the mercy of the various amateur radio clubs and organizations to provide him with the necessary input to make such a volume a reality. However, due to the apparent lack of interest of so many to submit information about their respective awards programs, we have almost discounted the idea altogether. Those who are theory-oriented will understand that no input is directly proportional to negative output!

However, to preserve the well-known Wayne Green tradition, "never say die," another attempt will be made to remuster the readership for their help to fill this void in our award files. We could use data on any award program you or your local club may be sponsoring, as well as any information regarding other award programs you may be aware of.

When you forward the various rules for each award, be sure to include an original of each award certificate so that it may be published in its entirety. After all, this is free advertising, ladies and gents! Don't you realize the exposure you'll be getting? The fact is, you will not have to pay $1500 per page as all advertisers have to just to get their message across to the readers. Take advantage of this unbelievable offer which only Wayne Green himself could extend to the readers of the most popular magazine in the hobby!

Send your award program rules and original award certificates directly to: Awards Directory, Attn: Bill Gosney KE7C, 2665 Busby Road, Oak Harbor WA 98277. Do not delay—send me your input today. Then, over the months ahead, perhaps we can put together the directory you've all been waiting for.

INTERNATIONAL AMATEUR RADIO SOCIETY

The International Amateur Radio Society (IARS) is an achievement, educational, public service, and amateur radio honor fraternity. It is the parent organization for the International Certificate Hunters Club (CHC), the International Shortwave Listeners Certificate Hunters Club (SWL-CHC), the International Amateur Radio Journalistic Society (IARJS), and the International Flying Hams Club (FHC), along with many affiliated subdivisions worldwide called either chapters or amateur radio associations.

The IARS publishes the *International Amateur Radio Society Annual*, which incorporates *The Directory of Certificates and Awards*, copyrighted internationally. The IARS also publishes the newsletter *Dialog*, through the IARJS, and the newsletter *Xtra*, the official house organ which reports news, special events, DX forecasts, and other items of interest to all members.

Through the CHC, the IARS sponsors many operating events, community services, achievement awards, and on-the-air nets. The IARS and its affiliates do not engage in partisan politics, but do take interest and action with regard to matters concerning the world's radio amateurs. It seeks to assist and cooperate with the many national amateur radio organizations (such as the ARRL, RSGB, JARL, etc.) in nations the world over. Although we may not always agree with what or how they do things, we acknowledge their efforts and lend them our support and participation.

The purposes of this organization are:

- to create and maintain an international communications system composed primarily of on-the-air amateur radio networks for all amateurs;
- to institute educational training programs and activities designed to advance the radio amateur's operating proficiency and technical knowledge, with emphasis on on-the-air gentlemanly conduct and compliance with the intent and interest of applicable national regulatory laws;
- to institute worldwide educational programs promoting improved human relations, international goodwill, and fellowship among men and women everywhere, without restriction or discrimination as to race, creed, color, national origin, political views, or religious belief;
- to promote the concept that shortwave listeners (SWLs) are fraternal kin to licensed amateurs and should be included in their programs and affairs;
- to promote the general welfare and survival of amateur radio as established under the International Communications Treaty;
- to publish educational books, magazines, newsletters, and literature in fields relating to international amateur radio; and
- to provide a comprehensive awards program, through the CHC, and to encourage and document the communication skills displayed by licensed radio amateurs and shortwave listeners.

The IARS, IARJS, CHC, SWL-CHC, and the FHC were created by Clif Evans K6BX in 1960 and have been protected as part of the copyrighted works of the Directory of Certificates and Awards. At the time of OM Clif Evans' death, the IARS, IARJS, CHC, SWL-CHC, and the FHC, along with 100 chartered, affiliated subdivisions called either chapters or associations, had over 22,000 members on the rolls, representing over 250 countries from all six continents.

They are making every effort possible to contact all of the members they have lost touch with since the death of Clif Evans and the closing of the old headquarters. Individual notification has been sent to each member via the bureau, and new club literature has been sent (via air mail) to all previous officials and office holders along with many national organizations and radio clubs around the world.

They look forward to all of their members around the world returning to active status.

The *International Amateur Radio Society Annual* is a yearly publication containing operating information and technical data, schedules of coming events of interest to the amateur community, net listings, DX tips, and much more. Included in the *IARS Annual* is *The Directory of Certificates and Awards*, the most comprehensive digest and guide to award-hunting ever offered to the amateur. The *IARS Annual* is also the organization's yearbook, offering a retrospective view on the past year and a look into the coming year, complete with IARS information on rules, codes, membership listings, and other items of interest to both the membership and amateurs at large.

The *IARS Annual* is published, revised, and updated annually in November, and covers in depth those topics not found in other handbooks. No amateur radio library is complete without it!

IARS Divisions Defined

IARJS: an international organization that provides a free and uncensored outlet for ideas, opinions, and proposals on behalf of amateur radio, through articles submitted by its members. These articles appear in the IARJS newsletter, *Dialog*, which provides its contributors an opportunity to inform radio amateurs throughout the world of conditions and situations affecting amateur radio. *Dialog* is a forum in which journalists and editors from around the world can exchange thoughts, ideas, and opinions on all matters concerning the future of amateur radio.

CHC: an international organization created to maintain an international communications system composed primarily of on-the-air amateur radio networks for all amateurs. The CHC also provides a comprehensive awards program and a vehicle for the procurement of awards from the many organizations around the world. Through its

system of networks, it provides the availability of contacts necessary for the achievement of these awards.

SWL-CHC: a mirror image of the CHC. SWL-CHCers seek the same achievement as radio amateurs except on a heard basis. All radio amateurs are also SWLs in half of all they do on the bands and are invited to participate in this division. The SWL-CHC also can provide the callsign necessary for QSLing through the bureau.

FHC: self-explanatory. Membership is available to any licensed radio amateur or SWL who holds, or has ever held, any nature of pilot's license or designation: aircraft, lighter-than-air vehicle, space, or glider.

Net Activity

CHC nets are 10, 15, 20, 40, and 75 meters as the demand dictates. Some of our nets are: CHC DX net, 0200 to 0500 UTC, 14.298 ± QRM, daily; CHC DX net, 1900 to 2200 UTC, 21.370 ± QRM, daily; and CHC Pacific family hour, 0000 to 0300 UTC, 21.370, daily.

Old CHC/New CHC

If you were familiar with the previous organization under Clif Evans K6BX, you will notice that they have instituted some drastic changes in both the way the club is handled and its value system. The new organization bears little resemblance in many areas to its predecessor, and they are sure you will find the changes to your liking. It is a blend of old and new and should be worthy of your review.

Membership is not a requirement for participation in either the awards program or any net activity. Membership is available with each division independently. Inquiries regarding membership are solicited. A bona fide interest in amateur radio is the only essential qualification (unless otherwise specified). When membership is attained, a membership number is issued which one holds *forever* regardless of change in name, call, QTH, class or license, or status of membership. Membership numbers and certificates are issued independently by each division. Membership in one division does not constitute membership in another.

Dues are payable during the first month of each year, January 1-31, following initial joining. Failure to pay dues will result in the member status being changed to inactive. Inactive members do not receive the newsletters, special club services, or voting rights when applicable. Inactive members always retain their original number. A member can go inactive in one division and still stay current in another. Payment of only present year's dues (not past) will restore any member to active status.

Newsletters are included with each membership, but are only available to members on active status. Articles are solicited from the members. They welcome information on all subjects pertaining to amateur radio, including hints and kinks, your local club's activity, awards issued by other organizations, etc.

Certificates of membership are issued to each new member with the approval of their application. They are of the highest quality and are very worthy of display.

Fees/dues for the IARS, CHC, SWl-CHC, and FHC are as follows: joining each division—$6.00 (overseas—$7.00, no prorating); yearly dues, each division—$4.00 (overseas—$5.00), all due Jan. 1st.

For additional information about this complex organization, address all inquiries to: Scott Douglas KB7SB, PO Box 46032, Los Angeles CA 90046.

CENTER OF POPULATION AWARD

The geographical population center of the USA is close to St. Louis MO. To achieve this award, work one station in each state which borders Missouri. Work one station in Arkansas, Illinois, Iowa, Kentucky, Kansas, Nebraska, Oklahoma, and Tennessee, plus one station in St. Louis MO. Send list showing calls and log data plus $1 to Dean Cowden KK0V, 2317 Lee St., Poplar Bluff MO 63901.

USA AWARDS PROGRAM

There is no limit to the frequency this award is issued an applicant. An applicant can work any band or mode of operation. Endorsements are $1.00 each. Application for this awards program should be made to Scott Douglas KB7SB, PO Box 46032, Los Angeles CA 90046.

The Worked All United States Award is issued in four classes. Class AA is for DX stations only and requires the applicant to work all 50 US states. Class A1 is for domestic stations and they, too, must work all 50 states for this class of award. Class A2 requires 40 states be worked while class A3 requires 30 states be worked and confirmed.

There is a Double Worked All States Award and the only requirement here is that you work two separate stations in the required number of states for the class of award you are attempting to pursue.

Likewise, there is a Triple Worked All States Award for which you must work a minimum of three separate stations in each of the required US states.

While you are at it, consider the Worked US States and State Capitals Award. Here, points are accumulated for each state and capital city worked. A single point is earned for each. To qualify for class A (DX only), 100 points must be earned. Class B requires 80 points, while class D requires 60 points.

To add insult to injury, included in the USA Awards Program is the Worked All States, Capitals, and Counties Award. Here again, the award is based on a point system. Each state is worth one point, two points are earned for each state capital city worked, and a total of ten points is earned for working all counties in a single state. Should you accumulate 600 county points, a trophy will be awarded. The class AA award is given for 600 points, class A for 500 points, class B for 400 points, class C for 300 points, class D for 200 points, class E for 100 points, and class F for 75 points.

Center of Population Award
United States of America
CHC
CHC
Award Number
Award Class
This is to certify that the operator of Amateur Radio Station SAMPLE has submitted satisfactory proof of two-way communications with the required number of Amateur Radio Stations located near the Population Center of the United States.
Date
Award Manager

ALL ALASKA COUNTIES

The Moose Horn Amateur Radio Club of Penai Peninsula, Alaska, announces the availability of their award for the State of Alaska. The award, in the form of a certificate, is available to licensed amateurs worldwide.

Certificates will be issued with endorsements for special modes or bands such as: class 1 (CW), class 2 (AM), class 3 (SSB), class 4 (RTTY), class 5 (mixed mode), and suffixes A (one band) and B (mixed bands). For example, certification or endorsement for an award on 20-meter SSB would be class 3A.

To qualify for this award, applicants must make four contacts in Alaska, one for each of the four judicial districts of Alaska. Of these, one contact must be made with a member of the Moose Horn Amateur Radio Club. All contacts must be made on or after August 15, 1961. It should be noted that the present system of judicial districts will be used in lieu of counties until such time that the State of Alaska adopts a system of actual counties.

To apply for the AACA, provide a list of confirmed contacts, certified by either two amateur operators, a local radio club official, or a notary public. Forward the verified list along with one US dollar or three (3) IRCs to cover air mail return of your award. All applications should be addressed to Ken Smith KL7JFY, PO Box 1682, Soldotna AK 99669.

By the way, here is a list of the

members of the Moose Horn ARC: KL7EJM, EK, EKN, EKO, FG, GIC, GJY, GNP, HHF, HQK, IEL, IFX, IN, ISO, ISP, IQQ, IQP, IZH, JDR, JFY, JL, KJ, LB, LE, NH, AL7BU, WL7ACQ, AEG, AJF, WB9NES, and VE6NH/KL7.

USS LING

On May 8, 1982, the weekend before Armed Forces Day, so as to not conflict with the operations of the Armed Forces activities, the Meadowlands Amateur Radio Association will be on board the *USS Ling* (SS297), docked on the Hackensack River in Hackensack, New Jersey, and will be operating under club station call N2BMN. The operation will begin on Saturday, May 8, at 1500Z and end at 2100Z. The following frequencies will be operated throughout the day, alternative between CW, SSB, and FM:

MODE	FREQ.	BAND
CW	14.060	20m
SSB	14.310	20m
CW	7.115	40m
CW	7.060	40m
SSB	7.250	40m
CW	28.110	10m
CW	28.060	10m
SSB	28.650	10m
CW	144.100	2m
SSB	144.150	2m
FM	146.150	2m
FM	146.550	2m

For confirmation of QSO, please send a large SASE (8½" x 11") to Ralph Francavilla N2BMN, 154 Redneck Avenue, Little Ferry NJ 07643.

NETHERLANDS-AMERICAN BICENTENNIAL

The Holland (MI) Amateur Radio Club will operate K8DAA plus other participating stations for the Netherlands-American Bicentennial during Tulip Time, May 12 through May 16, 1982. Operations will be in all phone bands and possibly some CW. One contact with K8DAA (club station) or two participating stations qualifies for a certificate. QSL to: HARC, PO Box 92, Zeeland MI 49464.

ARMED FORCES DAY

This year's observance of Armed Forces Day will include the operation of an amateur radio station from the United States Air Force Museum at Wright-Patterson Air Force Base, near Dayton, Ohio. Operating under the callsign K8DMZ, the station will be on the air from 1400Z to 2200Z on Saturday, May 15th. Operators will work primarily in the General class phone segments of 75, 40, 15, and 10 meters with periodic CW excursions to the Novice subbands. FM and SSB operations on 2 meters also are planned. The specific frequencies to be used will depend upon existing band conditions. To commemorate the event, the Museum will issue a special certificate for each two-way contact. This will be the first time an amateur radio has operated from the Museum in conjunction with a special event.

First established in 1923, the United States Air Force Museum is the oldest and largest military aviation museum in the world. It is located six miles northeast of Dayton at historic Wright-Patterson Air Force Base and is close to the Huffman Prairie site where the Wright Brothers conducted many experimental flights following their first successful powered flight at Kitty Hawk, North Carolina.

For further information, contact: Mr. Joe Ventolo, USAF Museum, Wright-Patterson AFB, Ohio 45433, (513)-255-3284, or the Museum's Public Affairs Officers, Dick Baughman or Linda Smith.

GATEWAY TO THE WEST ACHIEVEMENT AWARD

Work stations in states through which the Lewis and Clark expedition passed. Work one station in each of the following states: Idaho, Kansas, Montana, Nebraska, North Dakota, Oregon, South Dakota, and Washington, plus one station in St. Louis MO. Send list showing calls and log data plus $1 to Dean Cowden KKØV, 2317 Lee St., Poplar Bluff MO 63901.

CAPE HATTERAS LIGHTHOUSE I

The weekend of May 15 and 16, the Rockingham County ARC will be operating from the Cape Hatteras Lighthouse on the outer banks of North Carolina. This lighthouse, which at 208 feet is the tallest brick lighthouse in the country, is designated as a national historic landmark and is seen by over a million visitors each year. But this beautiful sentinel is in danger of falling victim to the Atlantic's turbulent forces. Once 1500 feet from the shoreline, it now stands less than 70 feet from the water—despite various efforts to control the erosion.

The RCARC hopes its mini-expedition will help to draw national attention to this graceful and historic landmark. Operating frequencies will be 30 kHz up from the bottom of the General portion in each band, both phone and CW.

CAPE HATTERAS LIGHTHOUSE II

When the Cape Hatteras Lighthouse was completed in 1870, it was 1500 feet from the shoreline. Today, it is 70 feet—and closing. The Cary Amateur Radio Club, Cary, North Carolina, will draw world attention to the peril of this keeper of the "graveyard of the Atlantic." On May 29-30, whether the lighthouse is still standing or not, Cary ARC members and friends will put two HF stations on the air from a site close to "the big candle." The targeted time for operation is 9:00 am (1300Z), Saturday, May 29, to noon (1600Z), Sunday, May 30, 1982. Operation may start sooner and last longer, depending on conditions and people power.

Planned frequencies for operation are: CW-3552, 7052, 14052, 21052, and 28052 kHz; SSB-3988, 7288, 14288, 21388, and 28588 kHz. The callsign will be NB4L (New Blood for Lighthouse).

Every station making a contact with NB4L during the special event can receive a commemorative 8.5" x 11" certificate by sending an appropriate SASE (1 oz., folded or unfolded) with QSL card containing the correct log information to Chuck Davis NB4I, 304 Atchison St., Garner NC 27529.

There is a public effort to raise funds to save the Cape Hatteras Lighthouse from the onslaught of the Atlantic. While many of the Cary ARC members may favor that project, this special event is only meant to focus attention on the peril of the Lighthouse. There is no connection with any fund raising.

SECOND ANNUAL COMMEMORATION OF MT. ST. HELENS ERUPTION

W7AQ, the Yakima Amateur Radio Club, will operate a special event station in commemoration of the second anniversary of the eruption of Mt. St. Helens in Washington State.

On May 18, 1980, at approximately 8:32 am local time, Mount St. Helens, located in southwestern Washington State, erupted violently. The 9677-foot summit was reduced to 8364 feet. A crater 2100 feet in depth was produced. Over one cubic mile of matter was thrown into the atmosphere.

Yakima, Washington, is located 80 miles northeast of the volcano. W7AQ was starting its hamfest activities that morning. By 10:30 am, the sky became as black as midnight. The light of the sun would not be visible until the next day.

Over 600,000 tons of volcanic dust and ash, which covered the city of 50,000 up to one inch in depth, was removed by cleanup over the next several weeks.

Join us in commemoration from May 16 at 1800 to 0200 of May 17 UTC. Frequencies will be 25 kHz up from the bottom of the General phone edge, ± QRM and band conditions. CW will be up 25 kHz from the Novice band

edge, ± QRM and band conditions and at 14.050 ± QRM and band conditions. A QSL will be available for an SASE. Send QSLs to: W7AQ, Yakima ARC, PO Box 9211, Yakima WA 98909.

MEMPHIS TN

The Memphis (TN) Radio relay Club will operate on May 22 and 23, 1982, for a weekend of the sixth Memphis in May Festival. Frequencies: CW—7,125 kHz ± QRM and 14,180 kHz ± QRM; SSB—7,280 kHz, 14,305 kHz, 21,400 kHz, 28,650 kHz, and 146.52 MHz ± QRM. Operating hours: 1400-2000 UTC, May 22, and 1200-1800 UTC, May 23, 1982. Special certificates will be issued for confirmed contact and large 9" x 12" SASE sent to N4ERU or N4CWS, 2071 Victoria, Memphis TN 38116.

PORT JERVIS, NEW YORK

The Orange County ARC will operate WB2TSA to celebrate the tenth anniversary of the club and the diamond jubilee of the city of Port Jervis, New York, on May 29 from 1400-2200 UTC and May 30 from 1400-2000 UTC. Frequencies 10 kHz up from lower general phone bands. QSL for SASE to OCARC, PO Box 434, Cornwall-on-Hudson, New York 12520.

DOGWOOD FESTIVAL QSO PARTY

The annual Dogwood Festival celebrated in Fairfield, Connecticut, will also be observed on the air by members of the Greater Fairfield Amateur Radio Association with its Dogwood Festival QSO Party on Saturday, May 8th. Members of the club will operate on six amateur bands with the club call WB1CQO and explain the significance of the festival, which marks the blossoming of the 30,000 pink and white dogwood trees in the town of 55,000 persons. Fairfield's Dogwood Festival began in 1936, although the original trees were imported from Japan in 1895 and earlier. Thousands of visitors flock to see the pink and white blossoms in full bloom during May.

WB1CQO will be on the air May 8 from 1300-2200 UTC (9:00 am to 6:00 pm) EDST. A special commemorative QSL card will be available to confirm each QSO.

Dogwood Festival stations will operate on these SSB frequencies: 3.975, 7.235, 14.330, 21.420 and 28.710 MHz. FM operation: 146.55 simplex.

Special QSLs will be sent upon receipt of an SASE or IRCs to QSL manager Grace von Stein KA1JT, 248 Euclid Avenue, Fairfield CT 06432, USA.

BISHOP MULE DAYS

The Bishop (CA) Amateur Radio Club will operate KA6AMT from the mule capital of the world, Bishop, California, on May 31st in recognition of the annual Bishop Mule Days celebration.

Frequencies: Phone—3.905, 7.240, 14.295, and 146.34/94. Certificate for a large SASE sent to Bishop Amateur Radio Club, PO Box 1024, Bishop CA 93514.

TIMBUCTOO

A special event station will be operated by the Yuba-Sutter Amateur Radio Club from the historic gold rush town of Timbuctoo, located in the mother lode country of California's Sierra Nevadas. Listen for callsign N6DDP from 1700Z May 15, 1982, to 0100Z, May 16. For a commemorative QSL, send an SASE to Y-S ARC, PO Box 1169, Yuba City CA 95992. Frequencies: 28.620-.630, phone; 21.150-.160, CW; 14.310-.320, phone.

MOSCOW OLYMPICS

The Moscow, Tennessee summer "Olympics" will be held in Moscow on May 14, 15, and 16, 1982. Communications for this annual event will be provided by the Mid-South VHF Club of Memphis. A special events station, KU4K, will be operating SSB from the site on 28.8, 14.28, and 7.2 MHz. There will be an OSCAR station in operation as well. Amateurs contacting KU4K are invited to QSL via Box 88, Moscow TN 38057. The summer Olympics is a benefit educational fund for the children of the men who lost their lives in the aborted Iranian hostage rescue attempt. Last year over $30,000 was raised for the benefit of approximately 17 children.

W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

from page 8

against the speed of the brain and are stopped.

Once this limitation was understood, it made sense to stop trying to learn code with the old system. Articles were written about it and new code courses devised to get around that old slow method and the resulting plateau. I tried to get the ARRL to recognize the futility of their old system but got nowhere. Hams had always learned code that way and they were not going to change.

After giving up on the ARRL trying to help hams learn the code, I sat down and made up my own code tapes, using the new, much faster and easier, learning system. I brought these out on cassettes as the *73* Blitz Code Course. I soon was getting letters from thousands of new hams thanking me for breaking the situation for them. Many had tried and tried the ARRL tapes and had thought they were never going to learn the code. Now they found that within a few hours they were on top of it.

My "Genesis" cassette starts off the beginner with the simplest of code characters, starting with E, I, S, and H. Then, instead of going on to the rest of the 26 letters, I immediately start sending simple words. These characters are each sent at 13 wpm speed, right from the start, thus reinforcing the sound of the character. The letters are spaced for five wpm copying.

The quick change to sending words gets the student used to success. Simple messages are being copied within minutes of starting to learn the code. This is a tremendous psychological boost.

The first one-hour tape teaches all of the letters, numbers, and punctuation marks, complete with some cute messages to make the learning experience fun. Many people are thus able to master all of the needed characters within a couple of hours of work with this tape.

The next step is my "Stickler" tape. . .again with all characters sent at 13 wpm speed, but spaced for six wpm throughout. By standardizing on 13 wpm sound patterns, the groundwork is laid for passing the 13 wpm exam. The "Stickler" is all five-character code groups and has been designed by me to be as frustrating as possible. By the time you are able to copy this code tape 100%, you should be able to breeze through any FCC exam for 5 wpm, half drunk and in your sleep. Many hams tell me that by the time they can handle this nasty tape they can copy 13 wpm of clear text with no problems.

I want to be sure that my students are overtrained. The test, particularly if it is in front of an FCC examiner, can throw even a normal person into panic. Well, there is nothing which calms the nerves as much as sitting down to do a code test and having the code sound like it is coming at two wpm. It's all in the psychology.

For the next test, I have the most miserable tape you've ever heard. The "Back Breaker," at 14 wpm, will drive you right up the wall. You won't believe what a bastard I am until you try my "Back Breaker" tape and suffer. Heh, heh. But again, when you sit down for 13 per in plain text you will not believe how slow it sounds. Many students start laughing when they hear it, losing all their tensions.

Every now and then someone writes in asking for a copy of the code groups on my cassettes. I flatly refuse to send them a copy. The reason is simple. . .I don't want them using the tapes to test code-copying speed. The system is to use the tapes, picking out the characters you recognize. You keep working at this until you automatically copy all of them. You'll know full well

when you miss one, so you don't need a cheat sheet to check. I want you to practice without the pressure to perform. Such pressures take all the fun out of code. Learning the code should be and can be fun. The more you can do to make it fun, the faster you are going to learn it. The more pressure you put on yourself, the longer it is going to take and the more unpleasant it is going to be.

The fact is that a skill with the code is a lot of fun to have. I'm hoping that we can eliminate the pressures entirely by getting the code test out of the ham license requirements, replacing it with a technical exam which means something. Then I think we will have a lot more hams developing their code ability... and enjoying it.

For the Extra class license, I have a 21 wpm cassette. Once you can handle this one you will be able to copy plain language at almost 30 wpm.

From a practical point of view there is little difference in learning the code at 13 wpm, 20 wpm, or even 50 wpm. The process is about the same and the length of time it takes to master any of these speeds is about the same. We have had some interesting experiments with starting newcomers right out at 50 wpm... and succeeding!

The *73* code courses are available from us by mail order. They are also stocked by most ham stores. These stores are still selling the ARRL course...the one which I feel has lost us several hundred thousand hams. Many clubs are still taking hour after hour, struggling with the 1930s code system from the League. Modern ideas sure are difficult to get across.

FIGHTING BACK

Every now and then I get a stroke of inspiration. The other day, while I was sitting in the lounge of a restaurant waiting for my name to be called to get a table, a chap next to me started smoking a cigar. Being, as you may know, a non-smoker, I had immediate need of a gas mask. Cigarettes are annoying, but a cigar or pipe is just too much. I got up and went to another restaurant.

There must be some way to fight back. There really has to be a way. That was the train of thought that brought on one of my all too few strokes of semigenius. If these turkeys can stink up the air I have to breathe, what's wrong with me stinking right back at them? How about an aerosol can of stink?

The first thought was to see about getting some cans of methane. Then I could sort of spray it and pretend that I fired back with a built-in weapon. But, alas, that might get ignited by the cigar or pipe and blow both of us to smithereens. No, the stink should be as offensive, but not be explosive. Perhaps skunk juice or hydrogen sulphide (rotten eggs). Yes, that would do it.

Put out in small pocket-(purse-) sized cans, I think it would sell. We might call it FIGHT BACK. It would be the first way for non-smokers to even the score. At $1 a can, it should sell well, Hmm, I'll have to look into this.

FOREIGN AID

One of the great benefits of amateur radio is that it allows us to sit and talk at length with hams in foreign countries. Unfortunately, few of us take the time to try to get to know amateurs in other countries, which is both our loss and theirs. Most of us are so swept up with contests and working countries that we say to hell with the chap at the other end.

I remember when I first moved to New Hampshire and went on the air. I found myself being called quite often by hams "needing New Hampshire." This quickly got to me. These chaps had no interest in me or in New Hampshire. All they were interested in was a QSL card. Now what is the possible value of a card from someone you didn't even bother to do more than casually bump into on the band? Hams needing New Hampshire seem to go out of their way not to get involved with any real conversation. They are almost always uninterested in paying any dues for the card in the way of an interesting contact. The QSL card is supposed to be the final courtesy. In this case, it is often the *only* courtesy involved.

Amateurs in all foreign countries run into this syndrome. In the rare ones, they seldom run into much else. If they get fed up with non-contacts with hams in search of their pasteboards and start making contacts by calling some of the stronger stations... or hams they know.. the hunters make their lives miserable with break-ins, tail-endings, and the like. If ignored, these QSL hunters can get vicious. This can diminish the fun of amateur radio substantially.

There probably isn't much that can be done about this whole lousy situation as long as the fascination continues for being high on the ARRL Honor Roll. Can I call it a dishonor roll?

At any rate, if you should want to fight the self-destructive urges to treat DX operators as mere QSL factories for your collection...providing you with an ever higher listing on an occasionally printed list in an obscure magazine and not much else to show for a lifetime of DX-ing...then perhaps you can join me in finding out that many DX hams are highly interesting people. I can tell you this: Once you start talking with them, you are sure to become addicted to it.

You know that in a country where there are from one to ten hams you are not likely to be talking with a blue-collar worker. It is highly likely that you will be talking with a relatively important or wealthy person. He is also likely to be particularly interesting, if you can get him to talk.

One of the conversational openers which I've found to work has to do with asking about their country. From there, I just sit back and listen. You know, it wouldn't hurt you to invest in one of the almanacs and read up on some of the smaller third-world countries so that you'll have some questions to ask which show more than a casual interest.

One of the subjects which may interest you has to do with aid funds the country is probably getting from ours. This can bring about an interesting conversation in some cases...and embarrassed silence in others. I have the advantage of getting around to visit hams in many of the third-world countries, so I ask about foreign aid when I visit them...and find many open to give vent to their feelings about this.

Since this is where I was heading when I started, it isn't exactly a digression. This business of foreign aid has been bugging me for a long time. The way the situation is set up right now, this money is wasted for the most part. It doesn't have to be.

As I wrote recently, the heads of a great many of the third-world nations are kept in position by virtue of the money they are able to grab for their supporters. Even the poorest of countries can be bled further by these pirates. But they are expert at working on the sympathies of the wealthier nations to get aid funds. The US is a particularly good sucker for this. Rarely does even 10% of this "aid" money accrue to the benefit of the poor people of the countries.

Presuming that Uncle Sap is going to continue to try to buy friendship (a commodity which seemingly can't be bought) with handouts, we could at least send aid which would be more difficult to turn into cash and at the same time provide some feedback of the money to US industries. My proposal is for future aid to take the form of goods, not cash, and that this should be goods from small business manufacturers rather than the big corporations. That would keep most of the lobbyists out of the pork barrel.

When we send cash, the most desired commodity, to these countries, most of it ends up in Switzerland without even coming near the people for whom it was intended.

Getting back to amateur radio, as you talk with the DX amateurs I think you'll find them enthusiastic for you to visit them. And I've found that a surprisingly high percentage of these amateurs manage to get to the US now and then. See if you can get them to include a day or two visiting you. Then you'll be able to find out a lot of things which they really couldn't talk about over the air.

Remember that 97.1e has to do with your ability to contribute to international goodwill. Pile-ups and tail-ending are not likely to do this. Presenting the friendly face of America to the world will. It's up to you whether we look like ugly Americans or not.

LETTERS

"CRACK THE WHIP"

First of all, I do enjoy your magazine and respect your right to an opinion on various topics (although sometimes I disagree), but on this business of a code-free license, I must make an objection.

I don't understand how Japan can have so many more amateurs than the US when the current *Callbooks* don't support this statement. But regardless, I will accept your word as you are in a better position than I am to know.

In my opinion, the reason why the US is declining in new engineers and high technology is because the youth of America is not made of the same fabric as that of our oriental brothers. At age 30, I am currently enrolled in an electronics program at a local community college and it is my impression that most of the "fresh-out-of-high-school" crowd are there merely because of parental pressure to get a degree. This school has one of the most thorough and modern electronics programs in the state and can compete equally with any big university on the educational level.

But the fact still remains that most of the younger students are "just going for a degree" and could really care less about the field they are pursuing. Possibly at one time they happened to open up a transistor radio, marveled at how it could do what it does, and decided this would be a less boring field than, let's say, social science or psychology.

The Japanese seem always to do things a little better, kind of a oneupsmanship, if you will, than their counterparts of the west. It is because they want to, Wayne . . .not because someone is standing over them with a whip!

If there is a minute problem with lids in Japan, what with their code-free licensing, that doesn't necessarily mean the same will hold true here.

You have stated that our technology could be much improved by technicians and engineers that were "sparked on" by being exposed to amateur radio during their youth. Well, if this is the case, then why didn't this happen with the Citizens Band service of the past? You couldn't have an easier way to get a ticket and get on the air than just to send off to the FCC for an instant license. Granted, a lot of superior hams graduated from the CB ranks and a lot of them probably went on to become technicians and engineers, but you know as well as I that the overwhelming majority did not. And look what the CB service is now without the *discipline*! Notice the emphasis on the word discipline? Learning code is a matter of discipline, period! There is no other word for it; that is it, in black and white. The Japanese are disciplined. As a matter of fact, they are noted for it. Maybe that is why they can handle a code-free licensing program without any problems.

How would you compare American youth to Japanese youth? Is one better than the other? No, but one is more disciplined. In WWII, we destroyed Japan and rebuilt it and, as a consequence, they became more disciplined. Given that fact, who do you think would be more arrogant? We have enough arrogance on the bands already. Let's try to get more discipline on the bands and not open up the floodgates for more arrogance. I don't think your theory holds too much water, Wayne. I teach new Novices and they *can* learn the code and *enjoy* doing so. It's just a matter of presentation and a little discipline.

It's been a while since this country has led the industry and I'm afraid it will be a lot longer until we can change the attitude of the people, especially that of the youth. Besides, if the overwhelming majority of hams today don't prefer a code-free license, why fight it? This *is* supposed to be our service, isn't it? We should have some say about how we want it! There will always be enough people to keep us a viable commodity on the FCC "exchange." And those are the ones we want. *Disciplined!*

Dave Peckham KD9D
Decatur IL

Dave, such a bunch of questions! Good ones, though, so let me tackle them one at a time. First, regarding the Callbook. *If they listed only the Extra class US hams, the US* Callbook *would be small, too. The Japanese* Callbook *is huge because they list all classes of licensees . . .over half a million of them. Now, about American kids and technology. . .the magic happens in the teen years. In the past, about 75% of the new hams were teenagers, with the old ARRL polls showing 50% being either 14 or 15 years old. There is now and there always has been an enormous difference between the type of engineer we get from dedicated teenage hams and from people who decide to just go for a degree. That's the same now as it always was and the chap who goes for a degree is usually a grave disappointment by comparison. Boy, I've known a lot of 'em.*

Now about CB. Dave, think about it. . .the mess is awful, with piles of interference, contacts which are even more boring than most ham contacts (yes, I know that's hard to believe), bodacious signals, and so on. . .how do you honestly expect anything good to come from such an incubator? The few CBers who managed to be salvaged by friendly hams are a blessing to us and to CB, but they are few, with most of those exposed to CB recoiling from the gore. No, there is a world of difference between an interference-hassled contact on one of the CB channels and a half-hour rag chew with someone in Germany or Australia, so please don't try to equate the two in your mind.

The Japanese aren't any better than we are. They just went the right way when we went the wrong with that foolish attempt to return to prewar Class A and B licensing in 1963. We now know how to fill our bands with crazies. . .use a code test and let Bash do away with the technical requirements with his books and blitz one-day memorization bashes. If you want garbage, you know how to get it. And Dave, remember that in 1969 the overwhelming percentage of the hams hated two-meter FM and didn't want to read about it or hear about it. Every now and then amateur radio needs someone to provide some leadership. I've found that in the long run people (even hams) will think things through and eventually get away from slogan thinking and work for what is in the long-range interest of amateur radio. We really couldn't ask for more proof that the code is a total failure as far as keeping out the nitwits (my apologies to any nitwits reading this and taking offense. . .which is an unlikely prospect) out of the hobby. Now that we have a way to easily cheat on the technical test, all we need is a way to cheat on the code and you have what you asked for: open sesame. I want to throw out the proven loser, code, and substitute a meaningful technical entry exam. . .one that can't be bashed.

If we get our spirit up, we can beat the hell out of any country in the world. . .including Japan. We can out-invent them, out-produce them, and out-quality them . . .if we decide that it is important to us. I want to get this started by getting kids infected with the ham bug when it is the easiest to pass along this infection: in high school. Dave, if we can get even half of the ham clubs to get some enthusiasm for selling amateur radio. . . classes. . .monitoring systems to keep our bands clean. . .emergency cadres so we will be ready to provide quick service for any kind of emergency. . .pressures on our high schools to start and support ham clubs. . .we'll be able to change the world in ten years. Or we can sulk and let amateur radio rot away the way it has for the last few years. Your choice. — Wayne.

CATCHING THE DREAM

Wayne, your editorials always ring my bell. You have the best interests of amateur radio at heart — we know that. I admire your business acumen; you are a true pioneer. I met you a couple of times at Dayton and enjoyed your magnetic and energetic personality.

Yet, agreement we don't have. You constantly compare American and Japanese amateurs to our disadvantage. Each has different goals and attitudes. The civilizations are vastly different. Japan may have no code requirement for entering amateur radio, but many Japanese amateurs are competent CW operators. I just don't believe our declining ranks results from the code requirement.

With that out of the way, what makes a prospective American

radio amateur stick with it, become a ham, and advance in rank? It's not the presence or absence of a requirement. It's the degree of personal drive inherent in the individual as well as how he latches onto the opportunities that come his way. As I see it, Wayne, if he is interested, he will keep at it until he makes the grade.

If Johnnie is let off from learning how to read, Johnnie is going to be let off from mathematics and a lot of other school requirements. From what I have seen of the Japanese civilization, Hiko and Toshio are not passed for non-achievement in school. Japanese education is strict and no-nonsense.

I learned Morse code in the Boy Scouts; my high school supported an excellent radio club. While a senior, I was permitted an operating hour daily in the club station as long as my grades were up. True, I had advantages, but I made use of them and passed my exams fair and square fifty years ago. Passed my Extra class thirty years ago.

Continue to agitate against the code requirement, Wayne, but I don't think it will stop the young in heart who have really caught the dream.

Paul L. Schmidt W9HD
Bloomfield IN

Paul, I agree with you. I don't think the code has much to do with our declining ranks. I think that if we can get the kids exposed to amateur radio rather than CB. . .or drugs. . .we'll get into clining ranks. The code is a loser as far as separating the wheat from the chaff. We need to get back to having this a technical hobby. If we insist on hams having an understanding of radio instead of merely having to pass a stupid code-skill test, a test which has flooded us with dregs from the pits. . .we might be able to look for some progress and have more pride in our hobby and hams. The cretins who are screwing up amateur radio are naturally repelled by 73, so I can write freely about them. You are right about education, too. . .there is much to be said for some of the no-nonsense Japanese approach as opposed to the Dr. Spock permissiveness which we have fallen into over the last twenty years. Every psychological survey shows that kids respond better to much stricter guidelines. . .and are happier. But that would force the average parent to look up from the television set now and then. . .so forget it. No, if we're going to get kids out of the mess they're in, we're going to have to trap them with the fun of amateur radio. . .the fun of talking with the world. . .the fun of building. . .the fun of learning . . .of experimenting. . .of doing things few others can do. I feel this is a tremendous resource and should be used to change our country and give it back some pride. — Wayne.

CALL FOR PAPERS

Papers are invited for the 1982 Annual VHF Conference to be sponsored on October 23, 1982, by the Electrical Engineering department, Western Michigan University. Principal emphasis will be placed on engineering developments applied to radio communication, design, and construction on the frequencies of 30 to 1200 MHz. Papers on a wide range of subjects are solicited including, but not necessarily limited to, these:

Antennas and transmission lines
Applications of microprocessors
Audio-frequency equipment used with VHF transmitters and receivers
Emergency gear
Grounding and shielding
Keying, break-in, and control circuits
Measurements and test equipment for VHF
Mobile and portable equipment
Modulation and mixing
Narrowband voice modulation
Noise reduction
Phase-locked loop uses
Picture transmission and reception
Power supplies including switchers
Production technology and model building
Propagation
Recent equipment/new apparatus
RTTY
Satellite and Moonbounce topics
State-of-the-art semiconductors, ICs, and filters with applications
Transceivers

One of the basic purposes of this Conference is to provide a maximum opportunity to present findings by those experimenting, designing, constructing, testing, and inquiring into problems and methods applicable to VHF radio. This is an opportunity for beginning or mature researchers to report their findings to their peers. We especially encourage the inexperienced inquirers to obtain some experience by presenting a paper at our VHF Conference.

Authors wishing to present papers should send a synopsis or abstract (typically one or two pages with diagrams) describing the paper to Dr. Glade Wilcox W9UHF, Chairman, VHF Conference, Department of Electrical Engineering, Western Michigan University, Kalamazoo MI 49008. Foreign authors are requested to have a US contact.

Deadline for submission of synopses is June 30, 1982. Speakers will be notified of acceptance by July 4, 1982. Reproducible copy for the printed proceedings should be mailed to the Chairman two weeks prior to the day of the Conference.

Glade Wilcox W9UHF
Kalamazoo MI

ELMER LIVES

After reading the November, 1981, issue, and noting the letters to the editor from Frank D. Windsor and Tom Taorimina, I felt that I could no longer be silent. I am an aspiring Novice who hopefully will have upgraded to General by the time you receive this.

I became interested in ham radio as a youngster, but did not have the time necessary to devote due to college, medical school, residency, and then early struggling years of practice. In November, 1981, I learned the code and began to study theory. I immediately ran into problems, and needed to discuss my problems with someone more knowledgeable than myself. One of my patients (N9ATB) overheard my predicament and offered his services. Within two weeks, he had guided me past all of the rough spots; frequently he allowed me to listen and observe at his home while he made QSOs. He administered my Novice examination for me in early January.

As I progressed and started to increase my code speed, several other hams became known to me. I also discovered that another physician in my community was a ham. KB9DD has spent many hours working with me and has even made practice QSO tapes for me so that I could become more proficient at code and be really ready for the General exam. His assistance has been invaluable to me.

Through people like this I have come to truly appreciate the amateur radio spirit. I am no babe-in-the-woods: I have heard the foul language on 20 and am aware of the other problems that Frank and Tom illustrate, but I am certainly not convinced that things are as bad as they say. Elmer is sure alive and well here. All of the hams I know are courteous, helpful, and represent their hobby as true gentlemen. It is my privilege to join their ranks. I only hope that someday I can provide as much help and encouragement to a potential licensee.

Gregory L. Darrow, M.D.
Janesville WI

CHEAP-SCAN!

I read your article by Jeff DeTray WB8BTH regarding memory scan for the TR-9000. I am the owner of one myself and, like Jeff, realized to top off a great rig surely Kenwood could have had a memory scan. Well, here's the bottom line: the TR-9000 does have a memory scan; they just haven't brought the function out to a control! I sympathize with Jeff. His memory scan cost him $39.95; mine cost the price of one silicon diode, two pieces of wire, and some thinking.

The TR-9000 is microprocessor-controlled. (At this point, get your TR-9000 manual out.) Find the circuit diagram of board X53-11G0-11. (If you don't have a manual, rip the lid off your rig and remove the front control section by removing 4 screws, 2 on each side — allowing the front section to be moved to see and work on the board behind it.) Note Q15, the microprocessor; now all you have to do is connect pin 13 (PE-1) through a silicon diode to pin 38 (PB-1). Obviously, you won't want the scanner running continually, so a switch is needed. As some of the switches on the TR-9000 are DPDT and only used as SPST, I used the unused side of the NB switch.

Trace PE-1 + PB-1 on the board 'til a suitable pick-off point is found. Then remove the front panel, remove the power/volume control, and you will see

on the circuit board where one side of the NB switch is not used.

The result is that when NB is out, the scanner is in and can be controlled by scan and hold buttons manually. And when a signal is present, it will stop until it ceases, and then continue. If mike P/T is operated, the scanner will stop and has to be restarted manually by pushing SCAN on your rig.

A simple addition to a fine rig.

R. M. Somann-Crawford VK7RC
Tasmania, Australia

FAR SCHOLARSHIPS

The Foundation for Amateur Radio, Inc. (FAR), a nonprofit organization with headquarters in Washington DC, plans to award nine scholarships for the academic year 1982-1983. The Foundation, composed of fifty local area amateur radio clubs, fully funds two of these scholarships from the proceeds of the Gaithersburg (MD) Hamfest. It administers, without cost to the donors, two scholarships for the Quarter Century Wireless Association and one each for the Richard G. Chichester Memorial, the Radio Club of America, the Young Ladies' Radio League, the Edmund B. Redington Memorial, and the Amateur Radio News Service. The last-named award is new this year.

Radio amateurs holding at least an FCC General class license or equivalent may compete for one or more of these awards if they plan to pursue a full-time course of studies beyond high school and are enrolled or have been accepted for enrollment in an accredited university, college, or technical school. The scholarship awards range from $300 to $900, with preference given in some of them to residents of specific geographical areas or the pursuit of certain study programs.

Additional information and an application form can be requested by a letter or QSL/postcard postmarked prior to May 31, 1982, from me.

The Foundation is devoted exclusively to promoting the interests of amateur radio and to the scientific, literary, and educational pursuits that advance the purposes of the Amateur Radio Service.

Hugh A. Turnbull W3ABC
6903 Rhode Island Avenue
College Park MD 20740

WOODPECKER REFORMED?

Over the past several months, the amateur bands have experienced to a varying degree deliberate interference that has acquired the label "The Woodpecker."

I have read of efforts to have this interference eliminated, by political and non-political bodies. However, all efforts in the past have not been effective. Based on the old-time adage of "if you can't lick them. . .", perhaps we could take advantage of this activity.

There are various propagation indicators and forecasts to aid amateurs in their efforts to communicate. Why cannot the Woodpecker be used in the same manner? It should certainly provide band-opening information, at least in some direction.

I wonder, if worldwide attention were given to this activity on a scheduled basis, perhaps the instigators of this noise might feel they are contributing too much to the welfare of others. When WWV and others give the solar-flux index, they could also give the "Woodpecker: forecast for various frequencies and times." I'm sure this information is being kept somewhere; let's put the Woodpecker to good use!

Glenn A. Churchill KA2IOI
Hudson Falls NY

FCC SPELLING

This is in reference to the letter from Bill Crowley on page 121 of the February, 1982, issue of *73 Magazine*.

There are no incorrectly spelled words in any of the Morse code tapes which the FCC uses to test amateur radio operators. The word "Springfield" is contained in some of the tapes, and it is spelled correctly, not with a "C" as Mr. Crowley alleges.

After the publication of Mr. Crowley's letter, the cassettes used by the Boston office were double-checked to see if the tapes had somehow been garbled or partially erased. It was found that these tapes are in good condition.

I regret that Mr. Crowley felt it necessary to encourage others to complain about a situation which does not exist. The Commission continues to make every possible effort to ensure that the amateur radio examinations are unambiguous and straightforward.

Vernon P. Wilson
Chief, Regional Services Division
FCC
Washington DC

Now we have heard the FCC's side of the story. What has been your experience? — N8RK.

A MATTER OF CHOICE

Sorry, Wayne, but Jim Owens W5FQE's letter (January, 1982) hit the nail on the head. My wife renewed last year's subscription only because she got it mixed up with *QST*.

Mitch Armstrong W7CDM
Puyallup WA

This letter was forwarded to us by QST. — *Ed.*

ATLANTA SCHOLARSHIPS

The Atlanta Radio Club announces that three (3) cash $500.00 scholarships will be awarded to graduating high-school seniors who enter an accredited college or university in the fall of 1982. Recipients must be duly licensed amateur radio operators at the time of application.

This is the fourth consecutive year in which the Atlanta Radio Club has been able to award scholarships to deserving amateurs. The three scholarships to be awarded in 1982 represent an increase of one additional scholarship over past years.

For additional information and application forms, write to Phil Latta W4GTS, Secretary, Atlanta Radio Club Scholarship Committee, 259 Weatherstone Parkway, Marietta GA 30067.

Completed applications, along with the required high-school transcript, must be postmarked not later than July 1, 1982.

Morris Johnson KB4IT
Atlanta GA

FATHER OF SSB?

Jeanne Hammond's excellent article, "The Father of FM," in the February, 1982, issue does not mention single sideband. I believe Major Armstrong was the first to use this type of radio communication, and I mentioned this in my book, *Radio Stations Common? Not This Kind.* If anyone does not agree with this record, would they please provide the source of the detail on who they believe was first with sideband? Major Armstrong had so many firsts that we now take for granted that Jeanne probably did not mention this one because she was concentrating on his accomplishments with FM.

Spud Roscoe VE1BC
Sambro Head NS
Canada

EYEBALL TIME

July of this year marks the 25th reunion of the VHF radio amateurs who were members of the Oklahoma Central 6-Meter Club, later known as the Oklahoma Central VHF Club. All persons who were at any time members of this group are urged to write immediately to T. W. Stevens W5VCJ, PO Box 976, Edmond OK 73083. Give him your name, address, and present call and indicate whether you are interested in attending the reunion, which will be held at the same time as but not in conjunction with the Oklahoma City "Ham Holiday."

Carl C. Drumeller W5JJ
Warr Acres OK

HAM HELP

I need a schematic and manual for a Fluke 8120A digital multimeter. I will pay for copies or will copy and return originals. Thanks.

Geoff. Chadwick KA7MKN
Box 361
Red Lodge MT 59068

I will pay any reasonable price for a manual and schematic for the Model 680-0 Itron frequency counter, or I will copy and return your original.

James Dickinson W4LLF
1408 Monmouth Ct. W.
Richmond VA 23233

NEW PRODUCTS

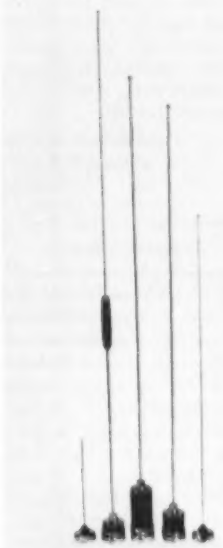
PROFESSIONAL-AMATEUR ANTENNA SERIES

Valor Enterprises has introduced the Pro-Am (Professional-Amateur) line of antennas, mounts, and accessories that are compatible with the Motorola TAD and TAE mounts, a system used extensively by the amateur and commercial communities.

Four mounts are offered. The model PAS ($11.25) is a basic surface mount that installs in a ¾" hole (lower left in photo). Valor's model PAS38 ($11.25) basic surface mount installs in a ⅜" hole (lower right), while the model PAT ($14.85) is a no-hole trunk mount (upper right). The fourth mount, model PAM ($22.00), is a low-profile magnetic base (upper left).

The Pro-Am antennas are available in four categories. Left to right in photo: models PAQ ($5.95), of which there are twelve versions, act as ¼-wave whips for frequencies between 136 and 866 MHz; model PUB ($24.50), a 5-dB collinear series, available for 440-512 MHz; model PLB ($26.35), a ½-wave, base-loaded antenna that can be selected to cover any frequency in the 27-to-54-MHz spectrum, and model PHB ($23.25), a ⅝-wave design that offers 3 dB of gain on the two-meter and 70-cm bands. (Another model PAQ is on the right.)

All models are engineered for demanding environments, featuring stainless-steel whips, nickle-chrome-brass parts, and "O"-ring seals. For more information, contact: *Valor Enterprises, 185 West Hamilton St., West Milton OH 45383.* Reader Service number 482.



Valor Enterprises' Pro-Am antennas.

Valor Enterprises' Pro-Am antenna mounts.

KENWOOD'S TS-930S HF TRANSCEIVER

Trio-Kenwood has announced the development of a top-of-the-line, all solid-state, high-frequency transceiver, the TS-930S. Designed to cover all amateur bands from 160 to 10 meters, the TS-930S also incorporates a 150-kHz-to-30-MHz general-coverage receiver which offers excellent dynamic range. Among the more interesting features to be found on this model are an automatic antenna tuner, dual digital vfos, eight memory channels, dual-mode noise blanker, i-f notch filter, fluorescent tube display, rf speech processor, rf step attenuator, and 100-kHz marker.

Special circuitry allows the operator to adjust the i-f passband characteristics for rejection of interference and includes a tunable audio filter for CW reception. Power input is 250 W PEP SSB, 250 W dc on CW, 140 W dc on FSK, and 80 W dc on AM. The built-in power supply operates on 120, 220, or 240 V ac. Kenwood's newest HF transceiver will have a list price under $2000. For more details, write to *Trio-Kenwood Communications, PO Box 7065, Compton CA 90224.*

Kenwood's TS-930S HF transceiver.

220-MHZ ALL-MODE AMPLIFIER

Mirage Communications Equipment, Inc., has announced the release of a new 220-MHz amplifier. The C106 amplifier is a solid-state, "all-mode" amplifier designed to be used in the 220-to-225-MHz amateur band. It will amplify a 10-Watt radio to more than 60 Watts output, or a 2-Watt radio to 25 Watts out. Since the C106 is biased as a linear amplifier, it can be keyed with as little as 300 milliwatts.

Other features include remote operation with the optional RC-1 remote head, and external or internal keying circuitry. The C106 lists for $199.95. For further information, contact *Mirage Communications Equipment, Inc., PO Box 1393, Gilroy CA 95020.* Reader Service number 490.

NO-RADIAL VERTICAL ANTENNA

Cushcraft has introduced the R3, a no-radial 10-, 15-, and 20-meter gain antenna. The R3 is perfect for limited-space applications like condominiums, apartments, mobile homes, and small urban lots. It is a ½-wavelength, endfed 22′ radiator with remote tuning for broadband coverage.

Installation is very simple, with only one square foot of space needed. It also can be telescoped for easy carrying and storage. Because of its unique design, the R3 does not need a tower, rotator, large support mast, or tuner. For more in-

Cushcraft's R3 no-radial vertical antenna.

Henry Radio's all-channel marine portable.

formation, contact *Cushcraft Corp., PO Box 4680, Manchester NH 03108.* Reader Service number 476.

ALL-CHANNEL MARINE PORTABLE

Henry Radio is introducing a marine VHF-band portable, the Tempo M1. The M1 operates on every marine channel, both US and international, with all the necessary offsets built in. It also includes all weather channels and a channel 16 override function. Channel selection is made by a thumbwheel switch on the top panel.

Other features include a one-hour, quick-charge-type battery, permanent memory, a high-power, 2½-Watt position, and a low-power, 1-Watt position. Accessories will include a charger, holster, amplifier, and high-capacity batteries.

The Tempo M1 is available through the Marine Division of Henry Radio. The suggested list price is $495.00. For more details, contact *Henry Radio, 2050 S. Bundy Dr., Los Angeles CA 90025; (215)-820-1234.* Reader Service number 480.

TELEREADER TERMINAL

The Hal Communications CWR-670 is a compact electronic communications terminal designed for reception of Baudot and ASCII radioteleprinter signals as well as Morse code signals. The CWR-670 includes built-in RTTY and Morse demodulators and video-generation circuits. The very small size of the CWR-670 makes it ideal for applications where space is limited.

The Hal CWR-670 Telereader terminal.

Since the terminal operates from 12 V dc, it may easily be used in locations where ac power is not readily available. The video-output screen of the CWR-670 is formatted in pages of 16 lines, 32 characters per line; a total of two page screens may be selected. The internal RTTY demodulator allows selection of three standard shifts. A parallel ASCII-printer output is also provided. The CWR-670 has a list price of $495.00. For more information, contact *Hal Communications, Box 365, Urbana IL 61801; (217)-367-7373.* Reader Service number 483.

REPEATER CONTROLLER

Advanced Computer Controls has introduced its new microcomputer-based RC-850 repeater controller. The controller's characteristics are remotely configured by the repeater owner with highly-secure tone commands. No hardware or software changes are required to modify control operator and user codes, ID and tail messages, Morse code speed, pitch and level, and a host of other functions.

The RC-850 controller's autopatch is based on a store/forward technique where the user enters a phone number and the controller actually dials the phone using either touchtone™ or dial pulses. Logic outputs allow remote control of equipment at the repeater site. A voice-telemetry option adds a natural-sounding speech synthesizer with analog-measurement capability.

The controller uses CMOS logic and low-power, analog circuitry to minimize current consumption. The RC-850 is priced from $1850. For more information, contact *Advanced Computer Controls, 10816 Northridge Square, Cupertino CA 95014; (408)-253-8085.* Reader Service number 478.

RTTY PROGRAM

The Egbert RTTY program transmits and receives RTTY without the need for any expensive interface hardware. The Apple cassette ports connect directly to the transmitter/receiver. Program capabilities include 60-, 67-, 75-, and 100-wpm Baudot and 110-baud ASCII, type-ahead buffer, canned messages, and automatic CW identification.

The program runs on the 48K Apple II and requires an Apple disk with DOS 3.2 or 3.3. The program and instruction manual cost $42.45 and are available from *W. H. Nail Co., 275 Lodgeview Dr., Oroville CA 95965.* Reader Service number 487.

The RC-850 repeater controller.

Centurion International's flexible antenna.

FLEXIBLE ANTENNA

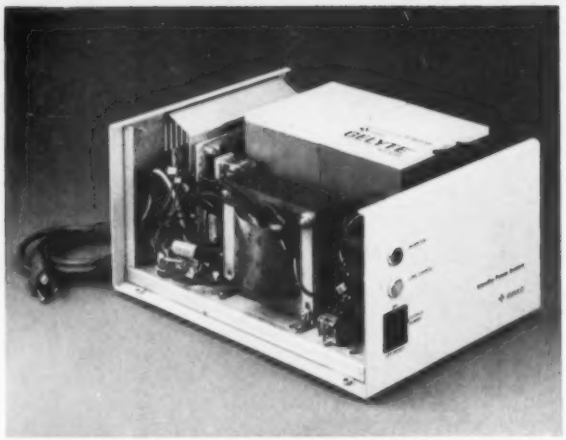
Centurion International has introduced a new flexible UHF gain antenna for use with handheld radios. The antenna features an endfed design and represents a ½-wave radiator with approximately 2.5 dB gain over a ¼-wave portable whip antenna.

The antenna is factory-tuned to discrete frequencies from 406 to 512 MHz and has a usable bandwidth of 20 MHz. The base is fitted with a BNC connector. Designated Style G, the new antenna ranges in length from 7 to 13 inches and lists for $17.50. For more information, write or call *Centurion International, PO Box 82846, Lincoln NE 68501; (402)-467-4491.* Reader Service number 484.

STANDBY POWER SYSTEM

The Portable Battery Division of Gould, Inc., has announced a Standby Power System (SPS) which provides 200 Watts of emergency power at 120 volts for 20 minutes, taking over the job of supplying power within one cycle of power failure.

As long as the power is constant into the SPS, the current passes through to the computer or other device being powered. However, if power drops below 102 volts, a sensing device immediately switches to an internal battery and turns on a red indicator light. If the power outage is brief, the device will automatically transfer back to line power and recharge the internal battery. Gould's standby power



The Gould standby power system.

system has a suggested price of $489.00. For more details, contact *Gould, Inc., Portable Battery Division, PO Box 43140, St. Paul MN 55164.* Reader Service number 486.

MORSEMATIC KEYER UPDATE

Advanced Electronic Applications, Inc., has announced the latest generation of the MorseMatic keyer, the MM-2. The MM-2 is a full-feature, paddle-input keyer that offers virtually all the features of the MM-1 predecessor plus CMOS memory and a new price. Like the MM-1, the MM-2 offers features that include an automatic serial-number generator, an automatic beacon mode, and an automatic speed-increasing Morse code trainer mode.

The MM-2 keyer comes in an rf-protecting metal package and is powered by 10 to 16 V dc. Independent + and – output keying allows connection to virtually any amateur transmitter. For further information on AEA's new $139.95 keyer, write *Advanced Electronic Applications, Inc., PO Box 2160, Lynwood WA 98036, or call (206)-775-7373.* Reader Service number 491.

COMPANDOR KIT

Advanced Analog Systems has announced a design evaluation kit for the Signetics NE572 dual-programmable compandor. The kit, designated AAS572, contains a printed circuit card, integrated circuits, and all components necessary to construct a complete audio compandor.

The system consists of two compressors and two expandors. Input to the compressor section consists of a high-performance, low-noise voltage follower. The system can be evaluated with either a single 2:1 compressor or by switching the ratio selector for 4:1 compression. There is also a choice between 1:2 and 1:4 expansion. Power requirements are plus and minus 15 V. The AAS572 costs $65.00 in single quantities. For more details, contact *Advanced Analog Systems, 790 Lucerne Dr., Sunnyvale CA 94086; (408)-730-9786.* Reader Service number 488.

Daiwa's booster amplifier.

BOOSTER AMPLIFIER

Daiwa announces a compact, lightweight amplifier, the LA2030, intended for the owners of two-meter, hand-held transceivers. It is available in three versions, depending on the power output of your transceiver. All versions can deliver a maximum of 15 or 30 Watts from 144 to 148 MHz.

The Daiwa LA2030 includes rf power metering and protection circuitry. The unit comes equipped with a BNC input and SO-239 output. Three feet of coax and BNC connectors are included in the $121.00 price. For more information, contact *MCM Communications, 858 E. Congress Park Dr., Centerville OH 45459; (513)-434-0031.* Reader Service number 481.

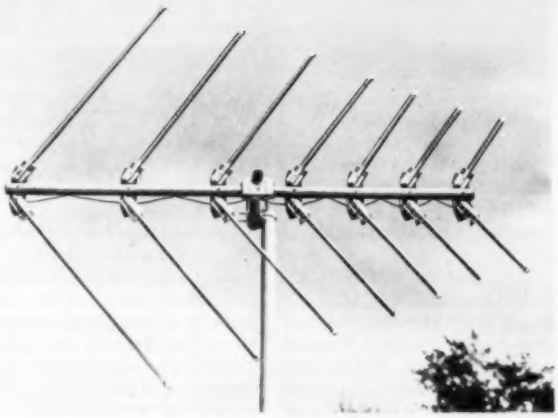
TWO-METER DDRR ANTENNA

High efficiency and small size are two key features of the Comrad Industries CR2A two-meter antenna. The CR2A is an adaptation of the Northrop Direction Discontinuity Ring Radiator (DDRR). Comrad's CR2A offers vertical polarization in a low-profile package suitable for either base or mobile use. Priced at $39.00, the CR2A is available from *Comrad Industries, 1635*

MorseMatic keyer update, the MM-2.

Comrad's two-meter DDRR antenna.

Heath's portable oscilloscope.



Low-power, wideband antenna.

West River Parkway, Grand Island NY 14072. Reader Service number 477.

SATELLITE TELEVISION RECEIVER

Arunta Engineering Company has introduced the DD 3000 stereo satellite television receiver. The DD 3000 can process multiplex, matrix, and discrete modes of stereo transmission in either wide- or narrow-deviation format.

Other significant innovations include a simplified installation requiring only an RG-59 cable between the receiver and remote downconverter, which transmits i-f, LNA power, and tuning voltage. With a suggested list price of $2995, the DD 3000 is available from *Arunta Engineering Co., PO Box 15082, Phoenix AZ 85060; (602)-956-7042.* Reader Service number 479.

PORTABLE OSCILLOSCOPE

Heath Company is introducing its first portable oscilloscope. The IO-3220 20-MHz oscilloscope can be used for most electronic measurement and comparison needs. It offers dual-trace capability, X-Y inputs, and a special algebraic add function. The IO-3220's sensitivity allows it to measure vertical signals as low as two millivolts. The scope's accuracy is rated within ± three percent on both horizontal and vertical measurements.

The IO-3220 oscilloscope is sold in kit form for $689.95. A factory-assembled version, the SO-3220, sells for $995.00. For more information on this portable oscilloscope, contact *Heath Company, Dept. 350-455, Benton Harbor MI 49022.* Reader Service number 489.

LOW-POWER WIDEBAND ANTENNA

Grove Enterprises has announced that their scanner beam antenna, the ANT-1, works for low-power transmitting as well as receiving. The beam works on 144-148 MHz, 220-225 MHz, and 420-450 MHz. The average vswr is 1.6:1. Because of its highly directional design, forward signal radiation is "targeted" towards distant repeaters or base stations, increasing the range of low-power transceivers.

For more information about the ANT-1, priced at $49.95, contact *Grove Enterprises, Dept. C, Brasstown NC 28902; (800)-438-8155.* Reader Service number 485.

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

Last month I described what may be the ultimate in RTTY output devices: a synthesized voice. Using the new Votrax Type 'N Talk, a self-contained speech synthesizer, and a 6800 computer, this setup allows conventional RTTY to be presented to the operator not as text on a page or view screen, but as an easily understandable computerized voice, capable of pronouncing whatever is sent. This month, let's look at the programming.

The program is written for my 6800 system, which, in its current state of evolution, uses the GIMIX GMXBUG version 3.0 monitor, the GIMIX VDM, and a Smoke Signal disk system, running under DOS68 version 6.1. Along with the video board, assigned to port #4 in the GIMIX system, GMXBUG supports a printer or other output device on either port #3 (serial) or port #4 (parallel). Output vectors are provided to direct data to the VDM, printer, or both. By connecting the Type 'N Talk to port #3, as a serial device running at 1200 baud, we can take advantage of this capability in the demonstration program. Lacking this feature, as in a system using another monitor, separate video and speech output routines could be used with minimal rewriting.

The program itself follows the flowchart presented last month fairly closely. Beginning at $0100, the first chores taken care of are housekeeping: clearing the screen, setting the GIMIX-software-controlled bell to a high pitch and short duration, and initializing the PIA for input. The output vector is also set so that both the screen and voice are initially active.

The actual receiving loop is next down the line. The keyboard is checked for input first. If there is no data found (we will cover what happens when there is input in a little bit), the PIA is checked. The RTTY input is fed to the least significant bit of the "B" side (B0) of a PIA located in port #5. If a START pulse is not found, then a loop back to the keyboard check is executed. By the way, since we are interfacing via an RS-232-type line to the demodulator, recall that the START, which is sent as a "0" level (or space), is represented by a positive voltage. Thus, reading a "1" on the B0 line translates to a space; a "0" is mark, the resting condition.

Once a START pulse is found, a counter is set up and five data pulses are read in. The step-by-step process is covered in the remarks in the program source listing. After screening for case shifts, spaces (which initiate a downshift-on-space), and carriage returns, otherwise unremarkable letters are decoded in a simple indexed table lookup.

The ASCII character, once retrieved from the table, is output by way of the GIMIX OUTCHR routine. As stated above, this routine will vector to either the screen only, the printer (voice) only, or both. However, I only provide the facility within this program to select screen only or screen and voice.

Now, let's get back to keyboard input. I wanted to provide a way to give commands without worrying over accidentally hitting a key and messing something up. So, in the best tradition of secure devices, only one key is recognized while receiving: the ESCAPE key. Hitting any other key is ignored. Striking the ESC key results in two effects. A flag, called the Command Flag (CMDFLG) is set to "1". This indicates that an ESC has been

hit, and that the next keyboard input should be examined as a command character. Then the local bell is rung, to verify receipt of the ESC.

Once the Command Flag has been set, several commands will be recognized by the system. A look at them reveals: V = voice *on*; S = silent—voice *off*; C = caps mode *on*; D = caps mode *off*.

The voice on and off commands are handled by storing a $01 or $00 in the output vector, respectively. The CAPS mode of operation was touched on last month, but deserves another word now. In the conventional mode, CAPS off, words are pronounced as they are spelled. However, groups of letters which are unpronounceable are still attempted, no matter how mangled the effort. Thus, a typical RTTY sign off, such as "N3BRD DE WA3AJR BCNU KKKK," is pronounced. . .well you get the picture if you try it yourself. To get around this problem, a CAPS mode is available, in which groups of capital letters will be spelled out one by one. This is exactly what we need in a RTTY program, and the "C" and "D" commands allow you to turn this mode on or off as needed.

One other command is recognized, by the way. Sending a second ESC will terminate the program and return to DOS. Just provides a clean getaway, if you follow me. Sending any other character will clear the CMDFLG and send nothing out to the Type 'N Talk or VDM.

Granted, this demonstration program is just that, a demonstration. But I feel it shows the kernel of a system that would be useful to many hams — especially visually-handicapped ones.

One feature of this column that many of you have expressed a particular fondness for is the range of material covered. I don't want to disappoint you, so let's go from high tech to basics. Bob Henry, a Boston MA reader, dropped me a line with two good questions. He begins by asking what a "cursor" is for. For the uninitiated, the cursor is the little box, blinking or solid, or sometimes an underline, that scoots along on a video screen just ahead of where you last typed. Why? Try to imagine a typewriter, Bob, where the whole page was somehow suspended in front of you. When you hit the keyboard the characters are placed on the page in order, but that little plastic thingy that normally sits dead center, and through a hole in the center of which the typebar hits the paper, is missing. How do you know where you are? Where to space? If a new line has started? With a typewriter all that information is provided by that guide and the position of the carriage. With a video screen, there ain't no such guide. That is what the cursor is for!

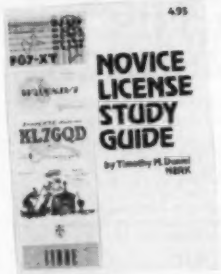
Bob's other question involves an item touched upon above: unshift-on-space. Recall that on RTTY, using five-level Murray code, two cases — letters and figures — are available. Now, if you miss a "LTRS" or "FIGS" code, the proper case will not be selected, and gibberish will result. On ham RTTY, numeral groups are rarely sent. The odds are that if a space is sent, what follows is in the letters case. Let me illustrate. If I send "DE WA3AJR IN MARYLAND," recall that the "3" is preceded by a FIGS and followed by a LTRS. If that LTRS is missed, what prints out is "DE WA3-'4 8, .-46)-,$", all after the 3 being in figures case. With downshift on space, the first space forces letters case, and "DE WA3-'4 IN MARYLAND" results. Less is missed.

Program listing.

```
                        1:          NAM   SPEAK.TTY
                        2:          OPT   NOE,NOG

                        4: ********************************
                        5: *    DEMONSTRATION PROGRAM     *
                        6: *            TO                *
                        7: * OUTPUT RTTY  AS SPEECH ON    *
                        8: *  THE VOTRAX TYPE 'N TALK     *
                        9: *                              *
                       10: * FOR MAY, 1982 "RTTY LOOP"     *
                       11: *  by MARC I. LEAVEY, M.D.     *
                       12: ********************************

                       14: $<>$ EXTERNAL REFERENCES $<>$
001B                   15: ESC     EQU   $1B
B014                   16: PIA     EQU   $B014
3F11                   17: OUTCHR  EQU   $3F11
3F16                   18: PCRLF   EQU   $3F16
3F17                   19: PFFEED  EQU   $3F17
3F26                   20: INKEY   EQU   $3F26
3F27                   21: PRINT   EQU   $3F27
A036                   22: OUTPTR  EQU   $A036
A037                   23: NULCNT  EQU   $A037
A03E                   24: PRFLAG  EQU   $A03E
A03F                   25: DURATN  EQU   $A03F
A041                   26: PERIOD  EQU   $A041
0263                   27: INWRMS  EQU   $0283
                       28: $<>$ MURRAY/ASCII TABLE $<>$
0000                   29:         ORG   $0
0000 7F                30: LTRTBL  FCB   $7F
0001 48                31:         FCC   \KQU\
0004 00                32:         FCB   0
0005 4A                33:         FCC   \JWAXFYSBDZIEVCPIGRL\
0017 00                34:         FCB   0
0018 48                35:         FCC   \HNM\
001B 20                36:         FCB   $20
001C 4F                37:         FCC   \O\
001D 00                38:         FCB   0
001E 54                39:         FCC   \T\
001F 00                40:         FCB   0
0020 7F                41: FIGTBL  FCB   $7F
0021 28                42:         FCC   \(17\
0024 00                43:         FCB   0
0025 27                44:         FCC   \'2-/!6\
002B 07                45:         FCB   7
002C 3F                46:         FCC   \?0"3;=084)\
0037 00                47:         FCB   0
0038 2E                48:         FCC   \.,$ 9\
003D 00                49:         FCB   0
003E 35                50:         FCC   \5\
003F 00                51:         FCB   0
                       52: * STORAGE AND STRINGS
0040 00 00             53: TABLE   FDB   0
0042 0B 00             54: RCVDLY  FDB   $B00       60 WPM (45.45 BAUD)
0044 00                55: CMDFLG  FCB   0
                       56: $< MAIN PROGRAM STARTS HERE >$
0100                   57:         ORG   $100
0100 3F 17             58: START   FDB   PFFEED     Clear video screen
0102 CE 2000           59:         LDX   #$2000     Set BIMIX "bell" for short
0105 FF A03F           60:         STX   DURATN     duration and a
0108 86 10             61:         LDA A #$10       high pitched
010A B7 A041           62:         STA A PERIOD     tone...
010D 86 FF             63:         LDA A #$FF
010F B7 A03E           64:         STA A PRFLAG     Set up for serial printer
0112 7F A037           65:         CLR   NULCNT     Output no nulls
0115 86 01             66:         LDA A #$01       Set output for both
0117 B7 A036           67:         STA A OUTPTR     Screen and "Printer" (Voice)
011A 4F                68: PIAINT  CLR A            Initialize input PIA
011B CE B014           69:         LDX   #PIA
011E A7 02             70:         STA A 2,X
0120 A7 03             71:         STA A 3,X
0122 86 04             72:         LDA A #$04
0124 A7 03             73:         STA A 3,X
                       74: *
                       75: * RECEIVING ROUTINE
                       76: *
0126 3F 26             77: RCVING  FDB   INKEY
0128 27 49             78:         BEQ   STBAUD

012A 7D 0044           79: COMAND  TST   CMDFLG     Has an ESC been sent?
012D 26 0D             80:         BNE   ESCSNT    Yes, try to process command
012F 81 1B             81:         CMP A #ESC       No, is this an ESC?
0131 26 40             82:         BNE   STBAUD     No, forget it!
0133 7C 0044           83:         INC   CMDFLG     Yes, set the Command Flag
0136 86 07             84:         LDA A #$07       Ring the local bell to
0138 3F 11             85:         FDB   OUTCHR     confirm ESC receipt.
013A 20 37             86:         BRA   STBAUD     ... and continue monitoring
013C 7F 0044           87: ESCSNT  CLR   CMDFLG     Clear the Command Flag
013F 81 1B             88:         CMP A #ESC       Is input another ESC?
0141 26 03             89:         BNE   NOTESC     No...
0143 7E D283           90:         JMP   INWRMS     Yes, get out of here!!
0146 81 43             91: NOTESC  CMP A #'C        C = CAPS ON
0148 26 04             92:         BNE   NOTAC
014A 86 15             93:         LDA A #$15       TNT Code for CAPS ON
014C 20 1D             94:         BRA   PNTESC     Send code to TNT
014E 81 44             95: NOTAC   CMP A #'D        D = CAPS OFF
0150 26 04             96:         BNE   NOTAD
0152 86 16             97:         LDA A #$16       TNT Code for CAPS OFF
0154 20 15             98:         BRA   PNTESC
0156 81 56             99: NOTAD   CMP A #'V        V = Voice ON
0158 26 07            100:         BNE   NOTAV
015A 86 01            101:         LDA A #$01
015C B7 A036          102:         STA A OUTPTR     Vector to Screen and "Printer"
015F 20 12            103:         BRA   STBAUD
0161 81 53            104: NOTAV  CMP A #'S        S = Voice OFF (Silent)
0163 26 0E            105:         BNE   STBAUD     Whoops!  Forget it follows...
0165 4F               106:         CLR A
0166 B7 A036          107:         STA A OUTPTR     Vector to Screen only
0169 20 08            108:         BRA   STBAUD
016B 36               109: PNTESC  PSH A            Send ESC seq to TNT - save A
016C 86 1B            110:         LDA A #ESC       Load it with an ESCAPE
016E 3F 27            111:         FDB   PRINT      Send that out
0170 32               112:         PUL A            Retrieve code to send
0171 3F 27            113:         FDB   PRINT      ... and send that out
0173 CE B014          114: STBAUD LDX   #PIA        Now check for TTY input
0176 A6 02            115:         LDA A 2,X        Look for a START pulse
0178 4D               116:         TST A
0179 27 AB            117:         BEQ   RCVING     Not there yet, keep looping
017B 8D 43            118:         BSR   RMS10      Found one, delay 1/2 pulse
017D C6 05            119:         LDA B #$05       Set up five bit counter
017F 4F               120:         CLR A            Clear the A accumulator
0180 48               121: CHLOOP ASL A            Shift the A accumulator one left
0181 8D 3A            122:         BSR   RMS20      Wait one pulse length
0183 CE B014          123:         LDX   #PIA       Pick up pulse in progress
0186 A6 02            124:         LDA A 2,X        Stuff it into character in formation
0188 5A               125:         DEC B            Decrement the counter
0189 5D               126:         TST B            Are we done?
018A 26 F4            127:         BNE   CHLOOP     No... do it again
018C 8D 2F            128:         BSR   RMS20      Yes, wait until last pulse is over
018E 81 1D            129:         CMP A #$1D       Is this a CAR RET?
0190 26 04            130:         BNE   ISFIGS     No, do next check
0192 3F 16            131:         FDB   PCRLF      Yes, output CR/LF pair
0194 20 90            132:         BRA   RCVING     ... and wait for next character
0196 81 04            133: ISFIGS CMP A #$04       Is this a FIGS?
0198 27 0F            134:         BEQ   FIGS       Yes, go to FIGS routine
019A 81 00            135:         CMP A #$00       Is this a LTRS?
019C 27 04            136:         BEQ   LTRS       Yes, go to LTRS routine
019E 81 1B            137:         CMP A #$1B       Is this a SPACE?
01A0 26 0F            138:         BNE   GETCHR     No, process character normally
01A2 CE 0000          139: LTRS   LDX   #LTRTBL    Choose LTRS table
01A5 DF 40            140:         STX   TABLE      Store it as active table
01A7 20 08            141:         BRA   GETCHR     Process character, if any
01A9 CE 0020          142: FIGS   LDX   #FIGTBL    Choose FIGS table
01AC DF 40            143:         STX   TABLE      Store it as active table
01AE 7E 0126          144:         JMP   RCVING     Look for next character
01B1 B7 01B7          145: GETCHR STA A LOCATE+1   Store Murray code as offset
01B4 DE 40            146:         LDX   TABLE      Pick up current table
01B6 A6 00            147: LOCATE LDA A X          Load A with ASCII value
01B8 3F 11            148:         FDB   OUTCHR     Put out through BIMIX routine
01BA 7E 012A          149:         JMP   RCVING     Loop for next character
                      150: *
01BD 8D 01            151: RMS20  BSR   RMS10      Two 10s = One 20!
01BF 01               152:         NOP
01C0 DE 42            153: RMS10  LDX   RCVDLY     Pick up delay factor
01C2 09               154: RMLOOP DEX              Decrement it
01C3 26 FD            155:         BNE   RMLOOP     Loop 'til done...
01C5 39               156:         RTS            ... then exit
                      157: *
0100                  158:         END   START
      NO ERROR(S) DETECTED
```

RADIO BOOKSHOP

FOR THE NOVICE



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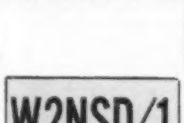

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6+ WPM—CT7306—This is the practice tape for the Novice and Technician licenses. It is made up of one solid hour of code, sent at the official FCC standard (no other tape we've heard uses these standards, so many people flunk the code when they are suddenly—under pressure—faced with characters sent at 13 wpm and spaced for 5 wpm). This tape is not memorizable, unlike the zany 5 wpm tape, since the code groups are entirely random characters sent in groups of five.

"BACK BREAKER"

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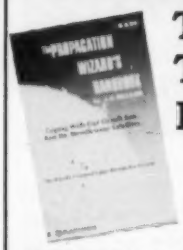

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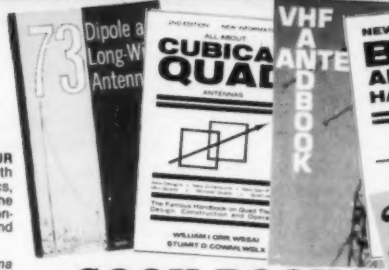

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QY0500	QSL CARDS—STYLE Y—500	$13.95
BK1189	THE RADIO AMATEUR ANTENNA HANDBOOK	$ 8.95
BK1044	RF & DIGITAL TEST EQUIPMENT	$ 5.95
BK1059	RTL COOKBOOK	$ 6.50
BX1000	SHELF BOX—1	$ 2.00
BX1001	SHELF BOXES—2-7	$1.50 each
BX1002	SHELF BOXES—8 AND UP	$1.25 each
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BK7311	SOME OF THE BEST FROM KILOBAUD	$10.95
BK7311	SOME OF THE BEST	$ 7.95
BK7351	SSB THE MISUNDERSTOOD MODE	$ 5.50
CT7350	SSTV TAPE	$ 5.95
SG1081	STUDY GUIDE—ADV. CLASS	$ 6.95
SG1080	STUDY GUIDE—EXTRA CLASS	$ 5.95
SG7357	STUDY GUIDE—NOVICE CLASS	$ 4.95
BK1190	THE TEN METER FM HANDBOOK	$ 4.95
LB7359	TEST EQUIP LIB V1—COMPONENT TESTERS	$ 4.95
LB7360	TEST EQUIP LIB V2—AUDIO TESTERS	$ 4.95
LB7361	TEST EQUIP LIB V3—RADIO EQUIP.	$ 4.95
LB7362	TEST EQUIP LIB V4—IC TEST EQ.	$ 4.95
BK7348	TOOLS & TECHNIQUES	$ 4.95
BK1063	TTL COOKBOOK	$ 9.50
BK1084	TVT COOKBOOK	$ 9.95
BK7382	UNDERSTANDING & PROGRAMMING MICROCOMPUTERS	$10.95
CH7300	U.S. AMATEUR RADIO CHART	$1.95
BK1089	VERTICAL BEAM & TRIANGLE ANTNS	$ 5.50
BK7388	VHF ANTENNA HANDBOOK	$ 5.95
BK1198	VHF HANDBOOK FOR RADIO AMATEURS	$ 8.95
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BK1184	WORLD RADIO TV HANDBOOK	$16.50
BK7315	WORLD REPEATER ATLAS	$ 4.95

Reader Service for facing page ↙15→

READER SERVICE

Please help us to bring you a better magazine—by answering these questions.

A. 73's technical articles are
- ☐ 1. Too difficult
- ☐ 2. Just right
- ☐ 3. Too simple

B. Which statement best describes the number of construction articles in each issue of 73?
- ☐ 1. Too many
- ☐ 2. On the average, just the right amount
- ☐ 3. Not enough

C. Which of the following best describes your feelings about a typical homebrew article in 73?
- ☐ 1. Easy to understand and build
- ☐ 2. Challenging, but I could handle it
- ☐ 3. Very tough, I wouldn't try it
- ☐ 4. I don't like construction articles

D. What are your hobbies and leisure activities? Check all that apply.
- ☐ 1. Animal breeding/grooming
- ☐ 2. Astronomy
- ☐ 3. Audio/visual entertainment
- ☐ 4. Aviation
- ☐ 5. Boating
- ☐ 6. Cars
- ☐ 7. Collecting
- ☐ 8. Community activities
- ☐ 9. Computers
- ☐ 10. Cooking
- ☐ 11. Crafts
- ☐ 12. Creative arts
- ☐ 13. Electronics/technological activities
- ☐ 14. Games
- ☐ 15. Gardening
- ☐ 16. Model Building
- ☐ 17. Photography/cinematography
- ☐ 18. Sports & outdoor activities
- ☐ 19. Travel
- ☐ 20. Other _____

E. What types of advertising (besides ham radio equipment) would you like to see in 73? Check all that apply.
- ☐ 1. Computer hardware
- ☐ 2. Computer software
- ☐ 3. Business products
- ☐ 4. Consumer products
- ☐ 5. Travel
- ☐ 6. Hobby equipment
- ☐ 7. Other _____

F. How do you like 73's coverage of satellite TV?
- ☐ 1. Love it, give us more
- ☐ 2. Some is okay, but you have gone too far
- ☐ 3. Hate it, try something else
- ☐ 4. Don't care

G. If you could choose one mode of operating, what would it be?
- ☐ 1. Two meter FM
- ☐ 2. Phone
- ☐ 3. CW
- ☐ 4. RTTY, SSTV, or other special modes

H. Which one of the following activities do you enjoy the most?
- ☐ 1. Ragchewing
- ☐ 2. Operating in a contest
- ☐ 3. Working DX
- ☐ 4. Building a homebrew project

I. How do you like published reviews of new amateur gear?
- ☐ 1. I read them and find the information useful
- ☐ 2. I read them but don't let them influence my buying
- ☐ 3. I don't read them

J. If you were an editor of 73 you would (check all that apply).
- ☐ 1. Publish more general interest articles
- ☐ 2. Include more monthly columns
- ☐ 3. Print more construction articles
- ☐ 4. Keep the magazine just as it is now

K. What is your primary source of information about amateur radio equipment? Check one only.
- ☐ 1. Magazines
- ☐ 2. Books
- ☐ 3. Hamfests
- ☐ 4. Stores
- ☐ 5. Friends
- ☐ 6. Other _____

If you are not a subscriber, please circle number 500.

Reader Service: Return this card to receive full information on the products advertised in this issue. Refer to the ad. You will find numbers near the logo of each advertiser. Each represents the advertiser's individual Reader Service Number. Circle the corresponding numbers on the card on this page, include your name, address & zip, and drop in a mailbox. In 4-6 weeks you'll hear from the advertiser directly.

This card is valid until June 30, 1982

1	6	11	16	21	126	131	136	141	146	251	256	261	266	271	376	381	386	391	396
2	7	12	17	22	127	132	137	142	147	252	257	262	267	272	377	382	387	392	397
3	8	13	18	23	128	133	138	143	148	253	258	263	268	273	378	383	388	393	398
4	9	14	19	24	129	134	139	144	149	254	259	264	269	274	379	384	389	394	399
5	10	15	20	25	130	135	140	145	150	255	260	265	270	275	380	385	390	395	400
26	31	36	41	46	151	156	161	166	171	276	281	286	291	296	401	406	411	416	421
27	32	37	42	47	152	157	162	167	172	277	282	287	292	297	402	407	412	417	422
28	33	38	43	48	153	158	163	168	173	278	283	288	293	298	403	408	413	418	423
29	34	39	44	49	154	159	164	169	174	279	284	289	294	299	404	409	414	419	424
30	35	40	45	50	155	160	165	170	175	280	285	290	295	300	405	410	415	420	425
51	56	61	66	71	176	181	186	191	196	301	306	311	316	321	426	431	436	441	446
52	57	62	67	72	177	182	187	192	197	302	307	312	317	322	427	432	437	442	447
53	58	63	68	73	178	183	188	193	198	303	308	313	318	323	428	433	438	443	448
54	59	64	69	74	179	184	189	194	199	304	309	314	319	324	429	434	439	444	449
55	60	65	70	75	180	185	190	195	200	305	310	315	320	325	430	435	440	445	450
76	81	86	91	96	201	206	211	216	221	326	331	336	341	346	451	456	461	466	471
77	82	87	92	97	202	207	212	217	222	327	332	337	342	347	452	457	462	467	472
78	83	88	93	98	203	208	213	218	223	328	333	338	343	348	453	458	463	468	473
79	84	89	94	99	204	209	214	219	224	329	334	339	344	349	454	459	464	469	474
80	85	90	95	100	205	210	215	220	225	330	335	340	345	350	455	460	465	470	475
101	106	111	116	121	226	231	236	241	246	351	356	361	366	371	476	481	486	491	496
102	107	112	117	122	227	232	237	242	247	352	357	362	367	372	477	482	487	492	497
103	108	113	118	123	228	233	238	243	248	353	358	363	368	373	478	483	488	493	498
104	109	114	119	124	229	234	239	244	249	354	359	364	369	374	479	484	489	494	499
105	110	115	120	125	230	235	240	245	250	355	360	365	370	375	480	485	490	495	500

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COUNTY HUNTERS
SSB CONTEST
Contest Periods:
0001 to 0800 GMT May 1
1200 GMT May 1 to 0800 May 2
1200 to 2400 GMT May 2

Please note the two 4-hour rest periods. Mobiles may be worked each time they change counties or bands. Mobiles that are worked again from the same country on a different band count for point credit only. Mobiles that are contacted on a county line count as one contact but 2 multipliers. Fixed stations may be worked by other fixed stations only once during the contest. Repeat QSOs between fixed stations on other bands are not permitted. Fixed stations may be worked by mobiles each time they change counties or bands. Repeat contacts between mobiles are permitted provided they are on a different band or county. Mixed-mode contacts are permitted provided that one station is on SSB. Contacts made on net frequencies will not be allowed for scoring in this year's contest.

EXCHANGE:

Signal report, county, and state or country.

FREQUENCIES:

Suggested frequencies are as follows: 3920-3940, 7220-7240, 14275-14295, 21375-21395, 28625-28650. There will be a "mobile window" of 10 kHz on the following frequencies: 3925-3935, 7225-7235, 14280-14290. Mobiles will be in this 10-kHz segment and fixed stations are asked to refrain from calling "CQ contest" in the mobile window. After working mobiles in the "window," fixed stations are requested to QSY outside the "window" to work fixed stations in the contest. This will allow the mobiles running lower power a chance to be heard and worked in the contest. There will be a special effort to work DX on 28.636 by mobiles.

SCORING:

Contact with a fixed US or Canadian station = 1 point; contact with a DX station (KL7 and KH6 count as DX) = 5 points; contact with a mobile station = 15 points. The multiplier is the total number of US counties plus Canadian stations worked. The final score is this multiplier times the total QSO points.

AWARDS:

MARAC plaques to the highest scoring fixed US or Canadian station, DX station, and top 2 scoring mobile stations. Certificates to the top 10 fixed and mobile stations in the US and Canada, and to the highest scoring station in each DX country.

ENTRIES:

Logs must show date and time, station worked, reports exchanged, county, state, band, claimed QSO points (1, 5, or 15), and each new multiplier must be numbered. Logs and summary sheets are free for a #10 SASE or SAE and appropriate IRCs. Write John Ferguson WØQWS, 3820 Stonewall Ct., Independence MO 64055. All entries must be received by June 15th to be eligible for awards. DX entries should use air mail. Winners will be announced at the 1982 Independent County Hunters Convention during July and in the MARAC newsletter.

SEVILLE
WORLDWIDE CONTEST
Starts: 1600 UTC May 1
Ends: 2000 UTC May 2

This contest is sponsored by the Seville (Spain) City Council and organized by the Seville Radio Club. Only single-operator entries are eligible. You may operate 24 hours of the 28-hour contest period, with 4 hours of rest taken in one or two periods. Contacts are allowed on SSB and CW, but a station may be worked only once per frequency band.

BANDS:

80 through 10 meters.

EXCHANGE:

RS(T) plus QSO number beginning with 001.

MULTIPLIER:

DXCC countries worked on each band.

POINTS:

Contacts between stations in the same country count 2 points. Contacts between stations in different countries count 3 points. Exception: Contacts between EA, EA6, EA8 and EA9 count only 2 points.

SCORING:

Total QSO points times sum of multiplier points.

AWARDS:

Certificates will be awarded to the top-scoring station in each continent, each country, and each W/K, VE, JA, and EA call area. The Seville City Council will award an all-expense paid trip to Seville's April Fair Feast to the top-scoring EA and non-EA stations.

ENTRIES:

All times must be in UTC. Indicate multipliers in your log the first time they are worked on each band. Make a separate log and dupe sheet for each band. Include a summary sheet containing scoring information for each band, a station description, and a signed declaration that you have observed the contest rules and the regulations for amateur radio in your country. Please include your comments and photographs.

Entries must be postmarked no later than June 30th. Send entries to: Seville Worldwide Contest, Radio Club Sevilla, PO Box 555, Sevilla, Spain.

DISQUALIFICATION:

Violation of the contest rules, violation of amateur radio regulations, unsportsmanlike conduct, excessive duplicate contacts, or unverified QSOs will be deemed sufficient cause for disqualification. Decisions of the Contest Committee are final.

MICHIGAN QSO PARTY
Contest Periods:
1800 GMT Saturday, May 15 to 0300 GMT Sunday, May 16
1100 GMT Sunday, May 16 to 0200 GMT Monday, May 17

This year's QSO party will be sponsored by the Oak Park ARC. Phone and CW are combined into one contest. Michigan stations can work Michigan counties for multipliers. A station may be contacted once on each band/mode. Portable mobiles may be counted as new contacts each time they change counties.

EXCHANGE:

RS(T), QSO number, QTH as

CALENDAR

May 1-2	**County Hunters SSB Contest**
May 15-17	**Michigan QSO Party**
May 22-23	**Mt. Saint Helens QSO Party**
Jun 5	**Jefferson Davis QSO Party**
Jun 12-13	**ARRL VHF QSO Party**
Jun 12-13	**Worldwide South America CW Contest**
Jun 18-20	**Summer SMIRK Party**
Jun 20-21	***A5 Magazine* Worldwide SSTV DX Contest**
Jun 26-27	**ARRL Field Day**
Jul 10-11	**IARU Radiosport**
Jul 17-18	**International QRP Contest**
Aug 7-8	**ARRL UHF Contest**
Aug 7-8	***A5 Magazine* F5TV UHF Contest**
Aug 14-15	**European DX Contest—CW**
Sep 11-12	**ARRL VHF QSO Party**
Sep 11-12	**European DX Contest—Phone**
Oct 16-17	**ARCI QRP CW QSO Party**
Nov 6-7	**ARRL Sweepstakes—CW**
Nov 13-14	**European DX Contest—RTTY**
Nov 20-21	**ARRL Sweepstakes—Phone**
Dec 4-5	**ARRL 160-Meter Contest**
Dec 11-12	**ARRL 10-Meter Contest**

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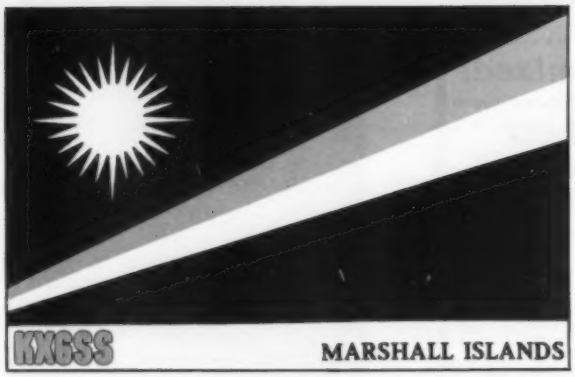

QSL OF THE MONTH: KX6SS

The colorful flag of the Marshall Islands provides an attractive design for the QSL of Keith R. Merrick KX6SS. Keith also holds callsigns KG6SS and WA1GYS.

To enter our QSL of the Month Contest, put your card *in an envelope* and mail it, along with your choice of any book from *73*'s Radio Bookshop, to *73 Magazine*, Pine Street, Peterborough NH 03458, Attention: QSL of the Month. Entries which are not sent in an envelope (the Postal Service does *occasionally* damage cards) and do not specify a book will not be considered.

state, country, or Michigan county.

FREQUENCIES:

Phone—1815, 3905, 7280, 14280, 21380, 28580.

CW—1810, 3540, 3725, 7035, 7125, 14035, 21035, 21125, 28035, 28125.

VHF—50.125, 145.025.

SCORING:

Multipliers are counted only once. Michigan stations score 1 point per phone QSO and multiply by the total number of states, countries, and Michigan counties. Each CW contact counts 2 points; KL7 and KH6 count as states; VE counts as a country. Maximum multiplier is 85.

Others take QSO points times the total number of Michigan counties. QSO points are 1 point per phone QSO and 2 points per CW QSO. Maximum multiplier is 83.

All stations score 5 points for each club station contact with W8MB.

VHF-only entries: same as above except multipliers per VHF band are added together for total multiplier. Score 5 points for each OSCAR QSO. No repeater contacts are allowed.

AWARDS:

Michigan trophies to high Michigan score, high Michigan (Upper Peninsula) score, high aggregate club score. Plaque to high VHF-only entry and high mobile. Certificates to high score in each county with a minimum of 30 QSOs. Out-of-state high trophy and certificates for high score in each state and country. Added this year is a trophy for the highest scoring Michigan multi-operator score.

ENTRIES:

A summary sheet is requested showing the scoring and other pertinent information, name and address in block letters, and a signed declaration that all rules and regulations have been observed. Michigan stations include club name for combined club score. Party contacts do not count toward the Michigan Achievement Award unless one fact about Michigan is communicated. Members of the Michigan Week QSO Party Committee are not eligible for individual awards. Decisions of the Contest Committee are final. Results will be final on July 31st and will be mailed to all entries. Mailing deadline is June 30th to: Mark Shaw K8ED, 3810 Woodman, Troy MI 48084.

MICHIGAN ACHIEVEMENT AWARD

This will be the 24th year that hams have had their own program to publicize Michigan and its products. Just as for past years, the Governor will award Achievement Certificates to hams who take part in telling the world of Michigan's unlimited resources, opportunities, and advantages. Certificates are awarded on the following basis:

1. A Michigan ham submits log information and names and addresses (if possible) of 15 or more contacts made to out-of-state or DX hams with information regarding Michigan.

2. An out-of-state ham, including Canada, submits log information and names and addresses (if possible) of at least five Michigan hams who relate facts to him about Michigan.

3. A foreign ham, excluding any resident of Canada, submits the call letters and name and address plus log information for at least one Michigan ham who has told him about Michigan.

Only QSOs made during Michigan Week, May 15-22, will be considered valid. All applications for certificates must be postmarked by July 1st and mailed to Governor William Milliken, Lansing MI 48902.

MT. SAINT HELENS QSO PARTY
Starts: 0001 GMT, May 22
Ends: 2359 GMT, May 23

The Clark County Amateur Radio Club, W7AIA, is pleased to announce the second annual QSO party marking the second anniversary of the cataclysmic explosion of nearby Mt. Saint Helens. This disastrous volcanic eruption took the life of Reid Blackburn KA7AMF, who was an active member of their club. Reid was monitoring a USGS observation station near the base of the mountain at the time of the eruption.

Any amateur station making one contact with W7AIA during the two days of the QSO party will be eligible to apply for the Mt. Saint Helens Award, a color certificate featuring a photograph of the awesome eruption of the volcano on May 18, 1980.

Look for W7AIA on the following frequencies (plus or minus QRM): SSB—3895, 7230, 14280, 21360, 28505; CW—3705, 7105, 21105, 28105; VHF—various Vancouver and Portland area repeaters.

To apply for the award, send log information or QSL card and $2.00 (or 8 IRCs) to: Award Manager, W7AIA, PO Box 1424, Vancouver WA 98668. All proceeds from the award will go to the Reid Blackburn Scholarship Fund which has been established by the *Columbian*, a Vancouver newspaper. So far, 647 amateurs have applied for the award, which has provided for a $1,000 contribution to the scholarship fund.

Kansas Amateur Radio

Public service in local and worldwide communications

NEWSLETTER OF THE MONTH

Amateur radio publications don't have to be either strictly local or strictly national in scope. This month's winner, *Kansas Amateur Radio*, is a good example of a regional publication.

Editor (and owner) KC0GL publishes *K.A.R.* quarterly in a magazine format. The January issue is printed on glossy stock and is 24 pages long. The layout is neat and the graphics are good; it's a professional-appearing publication. *Kansas Amateur Radio* covers what its name implies: the whole range of ham radio activities in Kansas, including net and club news, information about Kansas hams, and occasional technical articles.

This unique magazine is funded by reader contributions and a small amount of advertising revenue. It's a strictly nonprofit operation that relies almost totally on reader support, both financial and editorial — as KC0GL puts it, "If you write it, we will print it!"

A lot of small clubs don't have enough going on to warrant a full newsletter each month. Support of a publication like *Kansas Amateur Radio* may be a more practical way for some clubs to get their news into print than undertaking the effort required to put out a good club newsletter. A group of clubs might even consider banding together to produce a cooperative newsletter. There's strength in numbers.

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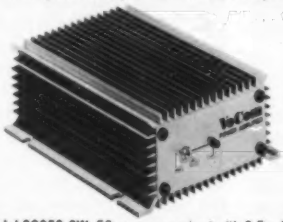

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REVIEW

ICOM'S IC-720A TRANSCEIVER

Although the four buildings at *73 Magazine* are each more than a mile apart, no telephone is needed when new equipment arrives for review. The *73* hams start forming lines the minute word gets around that equipment has arrived. Responding to that call, I was informed that the senior staff was so pleased with my previous reviews of dummy loads, power supplies, and BNC-to-garden-hose adaptors that they were going to give me a shot at a real radio.

Real radio is an understatement when it comes to Icom's newest all-mode, general-coverage transceiver, the 720A. This state-of-the-art solid-state rig should fill the bill for just about all devotees of the various modes of amateur communications available to us today on the HF bands. The first two days that the rig was available to me, it was put to use at W2NSD/1 where it was compared to several other transceivers in the station at the same time. In typical Icom fashion, the 720A's receiver outperformed all others — no mean feat when you consider that the Icom has a general-coverage receiver covering 100 kHz to 30 MHz.

The 720A arrived at my station the evening that the ARRL 10-meter contest started and I thought that I would attempt to put the rig through its paces during part of the contest. As it came from the box, 15 minutes prior to the start of the contest, those familiar words "some assembly required" echoed in my mind. The separate power supply (IC-PS15) attached to the 720A with no problem. Two of the phono jacks, on the rear panel, serve dual functions. As it comes from the box, these jacks are set up to provide an input for a low-band antenna and transverter/scope output. If you wish to use a linear amplifier, you must change the position of an internal connector, converting the function of these jacks to provide ALC and relay outputs. The conversion of these jacks required a few minutes study of the manual and less time in effecting the change.

With a few minutes left before the start of the contest, I thought I would take a look at the general-coverage frequencies. At that time of night, reception was good on the lower bands. I was surprised at the fidelity of the AM reception with only the standard filter in place.

My first encounter was with a Colombian station on 5 MHz playing traditional music. Having lived in Colombia for several years, it brought back memories and made me an instant SWL nut. Other treats in the first tour around the bands were an Austrian Christmas music special, a Spanish-language discussion of solar flux, a British Broadcasting Company London *Times* news program, a Portuguese discussion of the economic situation in the United States, and, of course, the old standby, Radio Moscow, with an editorial on the United States' deployment of the neutron bomb in Europe. No tour would have been complete without a stop on the low end of 8 MHz where the CW maritime traffic, with its near-perfect code, is a great place to increase or maintain your code speed.

Icom's IC-720A transceiver alongside the PS-15 12-volt power supply.

An interesting feature of the 720A was noted during this tour. While listening to one of the AM broadcasts, I noted that our old friend, the Russian woodpecker, was as prominent here as he is on the ham bands. Out of curiosity, I turned on the noise blanker and watched the interfering signal fall from 20 dB over S9 to S3. I still knew the offending signal was there, but it was much less bothersome.

Looking up at the clock, I found that the contest was already four hours old (later diagnosed as SWLer's disease). I decided to get a good night's rest and tackle the pileups in the morning. At first light I was on the bands. My first contact was W2NSD/1, 5-9 New Hampshire. Not bad, but I decided to use my limited time to hunt for countries. In eight hours, I racked up 47 countries and got a feel for how the 720A performed.

Operator's Manual

The first thing that impresses the new owner of a 720A is the clarity of the operator's manual. It begins with a concise walk-through of all controls and external connections (more than 50). It next provides detailed explanations of the major controls. A description of the circuit operation follows, remarkably understandable for a rig of this complexity. The section on maintenance and adjustments, along with photographs, covers most problems that might be encountered. While the schematic is small, a large-scale parts layout, in four colors, will prove invaluable for repairs.

My concern for the understandability of the owner's manual is sparked by the fact that I am a rural ham, living more than seventy miles from the nearest ham store and doing most repairs at home. With the 720A's manual, I would have no qualms about undertaking most repairs in the shack.

Icom Pioneers Again

The radio itself is small, measuring 4" × 9" × 12" and engineered to maximize the use of space. It appears to be most functional when placed at eye level. With the 720A, Icom introduces a pioneering method of function and mode selection, similar to the system used by many pocket calculators. Push-buttons replace many of the knobs used by old-fashioned rigs. Several of the controls are dual-function. While first impressions yield the feeling that you will never understand all of the controls, a few hours of use will convince you of the functionality of this method as you quickly jump from band to band, change modes, and select filters with this new system.

The receiver, unquestionably the hottest I have ever used, utilizes low-noise FETs in the rf amplifier to aid sensitivity and double conversion, with high side injection and steep-skirted filters for maximum selectivity. The receiver covers 0.1 to 30 MHz in 1-MHz steps. A two-position button allows you to step through the covered frequencies, stopping at ham bands only or at any 1-MHz segment. The operating frequency is determined by a microprocessor-controlled PLL. One of the most interesting features of this radio is a low-pass-filter unit which employs a motor-driven rotary relay-switching circuit that selects various filter components for each band. During receive, the low-pass unit offers a high degree of adjacent channel rejection; during transmit, it removes harmonic components. The relay also delivers different control voltages to a plug on the rear panel for each band, thus allowing automatic band change for a linear amplifier and automatic antenna selection with external relays.

Operating Controls

The number of controls offered by the 720A provides maximum flexibility but makes description of the actual ease of operation difficult. In order that my written description does justice to the user-friendly 720A, the controls will be divided into four groups.

- Frequency selection. This group includes band-stepping switches, the switch to select one of the two vfo's available, main tuning knob, tuning-rate select buttons, and RIT button.
- Mode Selection. These include CW, SSB, AM, FM, RTTY, and a reverse-sideband select button.

- Ancillary controls. These include the transmit/receive switch, af and rf gain controls, microphone and power output controls, noise blanker, pass-band tuning, and attenuator.
- Display. These include operating frequency, mode, sideband (u or l) and LEDs to indicate that certain functions or filters have been selected.

Operation

SSB and CW operation is straightforward. The frequency selection is made easy by the use of three tuning rates. Major changes can be made with the tuning speed button at a 1-kHz rate. The two other rates are 100 Hz and 10 Hz. The tuning knob is equipped with an adjustable brake that controls the friction on the knob. As it came from the factory, mine was too loose and had to be tightened. The rig is equipped with two vfo's and operation may be on either one or both (split), removing the need for an external vfo.

In this time of crowded band conditions, three features of the 720A make it an ideal operator's rig. The attenuator not only adds a 10-dB pad to the receiver front end, but also removes the rf amplifier. This reduces interfering signals and yields more stable reception. Pass-band tuning (PBT) accomplishes with one control what it takes other rigs two or three to do. PBT narrows the bandwidth (selectivity) of the frequencies that will pass through the crystal filter. This effectively reduces interference from nearby signals. The noise blanker, as I mentioned, is effective in reducing the interference from the woodpecker as well as the usual pulse-type trash such as ignition noise. Living out in the country where automobile traffic is about as common as QSL cards from BY-land, I parked my Subaru under a wire antenna and let it idle. If you are not familiar with this car, it is the noisiest (rf-wise) that you will run into. Letting it idle at 2000 rpm, I returned to the receiver and found the blanker to be effective.

The transmitter lived up to my expectations on SSB. With the obligatory "this is with the processor on" routine, I found that the processor had an above average or acceptable rating from the listeners. The VOX worked with no adjustment and it was not necessary to go under the top access lid.

Speaking of "under the lid," in addition to the fifty some odd controls and jacks that the 720A has on the outside, a convenient top access lid houses additional controls. CW sidetone, meter-function select, and VOX control, that require seldom adjustment, are housed under this top lid.

CW operation is just as easy as SSB. The rig did not have the optional 500-Hz filter, but the 1.1-kHz filter provided proved to be adequate for casual use. Upon selecting the CW mode, an LED indicates the filter width and the PBT functions as it does on SSB, allowing the PB width to be narrowed by 800 Hz. Semi-break-in is possible using the VOX switch.

Other Modes

The 720A is equipped for FSK operation and narrow shift tones are available to be sent to a terminal unit. AM operation had to be tried since there is an abundance of 75-meter phone stations here in the Northeast. Reports of "broadcast quality" were heard more than once, giving me the interest to look into this mode further. During operation in this mode, the meter measures carrier power and the operator is cautioned that if he expects to operate for more than ten minutes, power should be reduced to the 70% level.

The finals are protected by a circuit that reduces power in an inverse ratio to swr. In addition, there is a cooling fan that is activated during the transmit mode by a thermal switch. The operator's manual cautions you that should the fan go to high speed, you should *stop* operating at once. I must admit that prior to operating this radio I was a "tube final" type and somewhat nervous about solid-state finals. As I spend most of my operating time on wire antennas, using a tuner, I approached my first 720A band change with trepidation. Relieved by the rapid response of the protection circuit, I adopted a more cavalier attitude with later changes. Since I spend a good part of my time chasing HK3DMD around the bands trying to link up for our regular sked, I can now appreciate the benefits of quick band changes offered by the 720A's solid-state finals.

In summary, the Icom 720A, in the hands of this operator, has proven to be a versatile and practical ham rig. In the course of two months' operation, no major problems were encountered. While not inexpensive, the unit's distinctive features gave me hours of enjoyment and broadened my perspective. The proof of the pudding is in the eating. Should you doubt my opinions, go to your nearest dealer and try the rig yourself. I guess the strongest case for ownership of the 720A is to ask if anyone wants to buy my old rig.

The Icom IC-720A and matching PS-15 power supply have a list price of $1498. For more information, contact *Icom America, 2112 116th Ave. NE, Bellevue WA 98004.*

Joe Hayes AE1K
Stoddard NH

Top view of the 720A. The i-f module's cover has been removed, showing the location of the crystal filters.

KB1T CONTEST CALENDAR

There was a time, not too many years ago, when calendars were plain and ordinary. Functional, yes, but not very exciting. All that's changed. The walls of our homes and offices are now covered with calendars for cat haters and cat lovers, calendars from the Sierra Club and the oil companies, Right to Life and Playboy Philosophy calendars, even calendars devoted to pictures of polar bears (no kidding!). At long last, radio amateurs can join the calendar craze with one of their very own: the Contest Calendar from KB1T Radio Specialties.

The Contest Calendar is both functional and beautiful. On the functional side, it's a large, 18- x 18-inch, single sheet calendar, showing all 12 months at once. The center of the calendar features a great circle map of the Earth, centered on the USA, a handy aid to pointing your beam. Arrayed around the map are the individual calendars for the 12 months of the year. The weekends of major contests are highlighted in red with an abbreviated name of the contest and the mode (CW, phone). On the 1982 version, my count showed 28 contest weekends listed. The arrangement of the calendar on one sheet and the highlighting of the contest weekends make it easy to plan for upcoming oper-

ating activities—or anything else—at a glance.

And beautiful? The Contest Calendar is a work of art. The graphic design is bold, uncluttered and elegant. The entire calendar is printed on chromed mylar with the map in black. The 12 individual calendars have white backgrounds, with black numerals and red for the contest listings. It is the first and only ham shack accessory I have owned that non-amateurs seem to appreciate as much as fellow hams. It seems to draw more than its share of approving comments.

The Contest Calendar comes with four small adhesive tabs, allowing it to be mounted on a wall. I suspect many owners are framing theirs, however. Any active amateur, especially the contester, will appreciate the Contest Calendar. It's priced at $4.50, from *KB1T Radio Specialties, Box 1015, Amherst NH 03031*. Reader Service number 493.

Jeff DeTray WB8BTH
***73 Magazine* Staff**

The CES 635 Microdialer. (Photo by KA1LR)

PACKET RADIO BOOK

The preface to *Packet Radio*, published by Tab Books, Inc., begins by asserting, "This book was written to provide an easy entry into the utterly fascinating world of packet radio." I'm not sure that any single volume could give an *easy* introduction to this highly complex subject, but this book comes pretty close. Actually, it is must reading for anyone even mildly interested in RTTY, networking, or computer communications in general.

There is a wealth of practical information here that authors Robert Rouleau and Ian Hodgson give merely as a background to the main subject. They offer, for example, a fairly lively review of the RS-232C interface, with lots of discussion of the vagaries of interfacing nonstandard equipment. I for one was thrilled to discover that there is a pair of inexpensive chips available which convert TTL-level signals to RS-232C and back again!

The chapter on resource sharing via multiplexing should be read by everyone. It's only a basic introduction to the subject, but it is fascinating to someone who has never considered the subject before (which is to say, most hams!).

The chapters covering packet itself are solid and meaty—I won't reveal the chapter titles because they might scare off the faint-hearted. They sound more formidable than they really are.

The material on high-speed data transmission via HF radio is must reading for any ham who dreams of 9600-baud QSOs. The problems of bandwidth, S/N ratio, path loss multipath, Rayleigh fading, propagation delay distortions, and woefully unsuitable transmitters and receivers are discussed in a matter-of-fact manner. If you dream of a quick and dirty improvement to our present RTTY system, a read through this section will be a sobering experience.

The bottom line, though, is that packet techniques are being used, today, and with reasonable success. To find out more, buy this book! For information, contact: *Tab Books, Inc., Blue Ridge Summit PA 17214*. Reader Service number 495.

Paul Grupp KA1LR/4
Casselberry FL

THE CES MICRODIALER

For those who have never encountered an autodialing microphone before, it is a device designed to store several phone numbers and feed them into an FM transceiver at a predetermined speed at the press of a button. This is the basic function it must perform—but manufacturers and users alike soon discover that an autodialer must have several other features to perform adequately in the real world.

Like the Heathkit μMatic memory keyer (to be reviewed in June), the CES Microdialer is a second generation microprocessor-controlled device designed to make life a little easier for the amateur radio operator. Also like the Heathkit, the Microdialer has solved many of the problems experienced with the generation of devices that preceded it.

One of the most striking improvements incorporated into the Microdialer is found in its layout. It makes sense to have the buttons and the mike element on the same side of the microphone. Several microphones have the touchtone™ buttons on one side and the mike element on the other. These must be hung up carefully, to avoid pressing one of the buttons by accident. This is a small point, however, compared to some of the other problems the Microdialer solves.

Some owners of earlier autodialing microphones were quite chagrined to discover that their mikes occasionally suffered a glitch which locked their rig in the transmit mode. Hard luck if it happened when the rig was unattended! It was clearly injurious to the microphone, transceiver, and the blood pressure levels of others trying to use the frequency. CES cured the disease by removing the regulator chip (a source of heat) from the mike, putting in the radio instead, and tying the microprocessor's reset pin to the hangup hook. As long as the mike hanger on the vehicle's dashboard is grounded (and you use it!), there is no chance of an accidental transmission. Grounding the reset pin also lowers the mike's current drain from 120 mA off-hook to 60 mA on-hook. The dashboard in my car is plastic, so I simply ran a wire from a bolt in the firewall to one of the screws on the mike hanger. PL™ users should note that there is an extra conductor in the mike cable which can be used to enable a PL decoder when the mike is hung up and disable it when it is removed from its hanger. Nice touch!

Programmed to Please

The Microdialer really shines in the ease-of-use department. For example, when you dial a number in the automatic mode, the mike keys up the rig for .3 seconds before sending a tone—sort of a "look out equipment, here come some tones!" This feature alone allows me to use the Microdialer on several repeaters that won't accept my other dialer, which keys the PTT line at the same instant it sends the first tone.

Another welcome feature is the programmable pause. This allows you to program the autopatch access code (up to three digits) and a phone number into the same memory. The mike dials the access code, switches back to receive for two or three seconds so you can make sure that the dial tone is there, and then keys the transmitter and dials the number. If your repeater has some perverse speed requirements, you can program

the mike to send the access code at one speed and the phone number itself at another. And to make all this happen, all you have to do is push "•" and one of the numeric keys. The looks of envy you'll get from other hams when you set all this in motion are worth every penny you pay for the mike! If you are motivated by more practical considerations, consider that you can easily call home, the police, or whatever with the Microdialer, while your vehicle is in motion, without taking your eyes off the road for a second.

Entering numbers into memory is no easier or harder than with other autodialers we have tried. Memories 1 through 5 hold up to eleven digits, and 6 through 0 hold up to seven. Dialing speeds from one to eight digits per second can be programmed, and I am happy to report that there are several touchtone decoders in common use which can cope with the highest speed.

One repeater I use is plagued by a childish individual who frequently transmits tones while a user is trying to dial a number. With the Microdialer, I could bring up the patch and dial the number before our "friend" could find his or her mike.

Installing the Microdialer

If the Microdialer has any weakness, it lies in the simple fact that it involves some installation. Let's face it: There are a lot of guys who are too lazy to use a soldering iron. If a microphone doesn't come with the right plug for their rig attached, they aren't interested. To them I say, turn the page and read another article.Those of you who aren't afraid of a little work, read on!

The first thing you have to deal with is the regulator. CES solved a major problem by removing it from the mike case, but they created a minor one while doing it. You have to find a spot inside the rig for the tiny board which holds a 7805 regulator and a couple of filter caps. You also have to supply it with an unswitched source of 12 V dc. If you are using a rig over a year old, this doesn't present any problem, as there is usually lots of room for additions. I chose to use the Microdialer with my Kenwood TR-7730, one of the smallest rigs available. Getting the 12 V dc was easy—finding a spot big enough for the regulator board was not. There is a nice opening at the rear of the rig that Kenwood suggests is good for a CTCSS encoder. It may be OK for the encoder, but the rf from the adjacent final amplifier added an unhealthy dose of hum to our audio when the regulator board was put there. I finally ended up removing the internal speaker, which I never used anyway. This yielded plenty of room for the microphone's regulator and a Communications Specialists programmable CTCSS encoder/decoder board. I stored the speaker and its mounting hardware in a safe place, in case I wanted to restore it to its original condition. If there's a will, there 's a way, and if it'll fit in a 7730, it'll fit anywhere!

In Use

I found the Microdialer an extremely helpful addition to my mobile VHF installation. Compared to the microphone supplied with the TR-7730, the microphone element itself has a wider frequency response, with a noticeable improvement in lower midrange response. On the negative side of the ledger, it also has considerably less output, requiring the mike gain control inside the TR-7730 to be set much higher than previously required. This means that I cannot easily switch back and forth between the CES and Kenwood microphones.

I also found that the transmitter goes into the transmit mode for a brief moment when my sample is hung up on the grounded hanger. When I say brief, I really mean brief; it has never been long enough to bring up a repeater. I did not try the microphone with other radios, so I cannot say if this is only a problem with my particular installation or could be expected in others as well. In any case, it is not a serious problem, but you should be aware that it is there.

I am particularly fond of the microphone's shape and size. Many microphones must be held carefully, or your hand will cover the element, yielding muffled audio. You have to really work at it to make this happen with the Microdialer. It may be of little consequence to southerners, but dwellers in the land of snow and ice will be happy to hear that the microphone cable is made of a material which stays flexible at a far lower temperature than other cables we have encountered.

Another point worth noting is that when used in the manual mode, the Microdialer behaves like a normal, run-of-the-mill touchtone pad. Certain other autodialers become rather churlish in the manual mode, beeping irritably and locking up for a second or two if you try to make it do something it thinks it shouldn't be doing. Rest assured that the Microdialer is too well-mannered to engage in such loutish behavior!

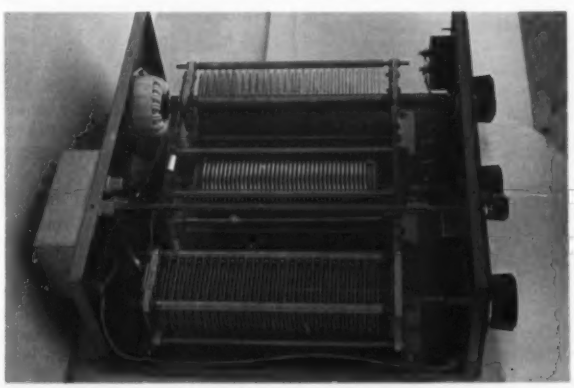
Conclusion

If you use an autopatch a lot, or frequently access your repeater's control functions, an autodialing microphone can uncomplicate your life. The CES Microdialer incorporates some much-needed improvements over previous units and is priced at $59.95 for a 500-Ω model. The only feature that is missed is the ability to permanently store a series of numbers on a ROM chip. Maybe next year...

For more information, contact *CES, 260 W. New England Ave., Winter Park FL 32789.* Reader Service number 494.

Paul Grupp KA1LR/4
Casselberry FL

The Heath SA-2060 tuner features two meters. (Photo by N8RK)



Two variable capacitors and a roller inductor form a T-network in Heath's SA-2060 tuner. (Photo by N8RK)

HEATHKIT'S SA-2060 TUNER

It's easy to say that a tuner's a tuner, but if that's so why can you build one for next to nothing or spend over six hundred dollars for a motorized autotuning marvel? The answer boils down to power handling capability and convenience. Heathkit's model SA-2060 antenna tuner represents a good compromise between the extremes of tuner design. Selling for $254.95, it's rated to handle the full legal power limit, contains a built-in wattmeter and antenna switch, and uses a roller inductor rather than the tapped coil used in many tuners, making it a lot easier to use than that coil-and-jumper-clips device you built as a Novice.

The SA-2060 uses the now standard T-network matching scheme and with its roller inductor can provide a match to some loads that tuners using tapped coils simply can't cope with. It

covers frequencies from 160 to 10 meters and can handle random wire or balanced feed antennas. A built-in 4:1 balun helps tame the wild impedances that are sometimes found when using tuned feeders.

When this kit arrived, my first thought was that there couldn't be much involved in building an antenna tuner, since at the minimum only two or three components are required. Well, when Heath tells you that you *build* this tuner, they mean it. It's up to you to assemble the two variable capacitors out of metal plates, ceramic insulators, and threaded rods. The roller inductor also needs assembly, although thankfully the coil itself is prewound.

Heath says that this kit is a three-evening project. That isn't far from the mark, although I spent considerably more time because of a modification I wanted to make (more on that later).

Although the instructions put the capacitor and coil assembly about halfway through the project, I'd suggest putting them together at the beginning so that all the little parts they use are out of your way. Assembly of the capacitors is for the most part very easy and great therapy after a hard day at work. Just keep slipping those little metal plates onto the assembly. It's a lot like threading popcorn onto a thread at Christmastime.

The rf sensing assembly for the wattmeter and the antenna switching circuitry are preassembled in a box which mounts on the back of the tuner chassis. Providing the critical wattmeter circuits already assembled and calibrated was a great move on the part of Heath. Not only did it speed up construction, but it's nice to be able to rely on their calibration (my tests show the SA-2060's meter to read within 5% of other meters used at W2NSD/1). The wattmeter actually uses two meters, one to show forward power on scales of 0-200 or 0-2000 Watts, and the second to read either reflected power (on scales of 0-50 or 0-500 Watts) or swr.

I found the reflected power mode to be easier to use than the swr mode when adjusting the tuner. All that's really necessary is to adjust for 0 Watts reflected power, so there's no need to know actual swr. Having dual meters is very convenient, since some tuning combinations can produce misleading reflected power or swr readings. By keeping an eye on both forward and reflected power, it's easy to spot these conditions and to tune for optimum settings.

The SA-2060 antenna switch provides three positions. One routes the signal through the wattmeter but bypasses the tuner, while the other two select coax-fed antennas which go through both the meter and the tuner circuitry. There's no way, however, to switch the tuner in or out of line on a specific antenna—If you want to run the antenna through the tuner, you must do so all the time. This isn't really such a bad thing, since the tuner does act as a low-pass filter and helps prevent TVI, but it is inconvenient to have to adjust the tuner before using that antenna even if the swr in the part of the band being used is low enough such that the tuner isn't really needed.

There is a serious problem with this antenna-switching scheme if you want to use both coaxial and wire-fed antennas. The random wire/balanced feed terminals are connected to the tuner *before* the antenna switch, with the result that any antenna hooked up to these terminals is always in line and will be paralleled with a coax antenna selected by the antenna switch. This renders the switching system almost useless, since before switching to a coax antenna you have to go behind the tuner to disconnect the wire one. Fortunately, the fix for this problem is rather simple if you're willing to drill a hole in the chassis and change around some wiring (see box and photo).

With the antenna switching changed as described, the tuner is a joy to use. It handles a full kilowatt with ease (although the tuner should be adjusted before running at the power level—no tuner is designed to handle the voltages that may appear when feeding a kW into 15:1 swr!), and it survived the toughest test I can think of. While driving a vee beam with full power on 80 meters, the open feeder arced through a supporting board. The feeder was burned in two and the board caught fire, but the tuner survived this rather severe mismatch with no more than a brief arc between capacitor plates. Never let it be said that we baby equipment at W2NSD/1!

In more normal use at my home station, the SA-2060 has easily matched every so-called radiator I've connected to it, including a very badly mismatched vertical, a more-than-random random wire, and a coax-fed collinear dipole that

SWITCHING MODIFICATION FOR THE HEATH TUNER

The Heathkit SA-2060 antenna-switching problem described in the review is easily correctable.

The purpose of this modification is to disconnect random wire or balanced feed antenna terminals from the tuner circuit unless switch position COAX 2 is chosen.

As originally designed, the random/balanced antenna terminals were connected to the output of the tuner *before* the antenna switch. Thus, if an antenna was connected to either of these terminals, it would always be fed in parallel with any coaxial feed antenna chosen by the antenna switch. To avoid radiating on two antennas at once, it was necessary to disconnect the wire antenna from the back of the tuner when a coax antenna was used, and no antenna could be connected to the switch position selected when a wire antenna was to be used. This arrangement rendered the antenna switch useless to those who use both coax- and wire-fed antennas.

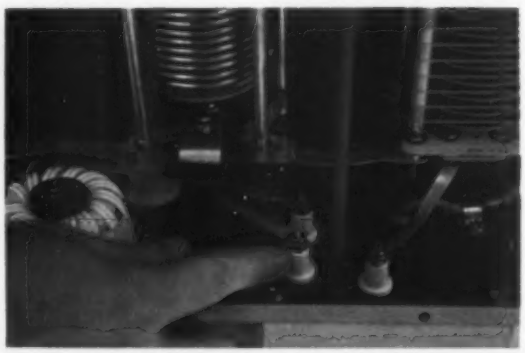
My solution was to move the connection point for the random/balanced terminals from the input of the coax switch to the COAX 2 output of the switch. Now, the wire antenna is connected to the tuner only when the COAX 2 position is selected, and a coax antenna can be used at COAX 1 without fear of feeding two antennas in parallel. The COAX 2 position can still be used to select a coax-fed antenna if no wire antenna is used.

The change involves mounting an additional ceramic feedthrough from the antenna switch box into the tuner chassis. This feedthrough is connected by a short strap to switch lug 6 inside the switch box. Lug 6 is also connected to the COAX 2 chassis connector.

The random antenna terminal is connected to the new feedthrough rather than to capacitor C2 as in the original design. No other internal connection is made to the random terminal. C2 is connected directly to the feedthrough from the switch box which was orginally connected to the random terminal. The additional parts necessary can be ordered from Heath.

After studying the layout of the tuner, the whole process is easier to do than to describe. The only cautions are to drill the new hole with enough clearance to allow the feedthrough to miss the lip of the switch box (see photo for feedthrough location) and to make sure all the rf-carrying straps have as much separation from each other and from the chassis as possible.

John Ackermann AG9V/1
***73 Magazine* Staff**



An extra feedthrough insulator was added to increase the versatility of Heath's SA-2060 tuner. (Photo by N8RK)

presented a proper match at no given frequency. This tuner replaced another inexpensive commercial one, and I've found the change to be most refreshing. I no longer have problems with being able to almost, but not quite, get a perfect match, and the built-in metering and switching (as modified) have eliminated the need for two other accessories, giving me a little more room on the operating table.

If you're in the market for an antenna tuner that includes some of the convenience features we've come to expect from the high-priced supertuners but still carries a reasonable price tag, the Heathkit SA-2060 may be your answer. The only real flaw with the unit, the antenna switching, won't bother those who don't use wire feeders, and those who do can easily cure the problem. You'll have to invest some of your time in building this tuner, but the results (and savings) can be gratifying.

For more information, contact the *Heath Company, Benton Harbor MI 49022.* Reader Service number 492.

John Ackermann AG9V/1
***73 Magazine* Staff**

FUN!

John Edwards KI2U
78-56 86th Street
Glendale NY 11385

HOBBY VIDEO

Offhand, I can think of only one occasion in my life when amateur radio and commercial video met. Since I need a justification for writing a column about hobby video in a ham magazine, let me tell you about it.

It happened on the day I took my Extra test (the time I passed). I had just left the Federal Building on New York's Varick Street with my interim permit clutched firmly in my fist. As I was making my way over to Washington Square to catch the subway back home, I suddenly noticed in front of me a bunch of klieg lights, cameras, and a typical Greenwich Village street with cars and street signs of an early-1960s vintage.

"Could you hold it a minute, fella?" a man in a light-colored windbreaker asked me.

"Sure," said I. "Hey, what's going on here?" I inquired, asking the obvious, as usual.

The guy in the windbreaker paused for a second, looked me over very closely, and said: "It's okay. Go on ahead. Your clothes fit into the period, anyway." So, with that I slipped between two wooden barriers and continued my eastward march.

I'm about halfway along the block when a taxi comes tearing down the street with a 1959 Chevy sedan in hot pursuit. The cab smashes into a fire hydrant directly across from me and two rough types jump out of the car and put the collar on the taxi driver. It was, of course, a part of a movie—a TV movie, as it turned out. And the Panavision camera caught me as a horrified onlooker. I later saw the movie on ABC, but I guess my scene landed on the editing room floor—I wasn't in the completed film.

So, that was the day broadcast television and ham radio made almost simultaneous appearances in my life. Listen, it may not be the greatest story ever told, but at least it gave me a lead to this month's column.

On a wildly different note, I know someone who is writing a high-school electronics textbook. As a plug for ham radio to a potentially ripe audience, this chap thought he would include some information about the OSCAR satellites in his book. My friend wrote to the ARRL asking for a couple of black and white photographs so that his readers could get an idea of what an amateur-built satellite looks like.

The upshot of his efforts, sad to say, was a letter from HQ saying that the League's OSCAR photos are for use only in their own publications and "are not for dissemination to the general public." Wonderful. So the League doesn't want the general public to know what the OSCAR satellites look like. It's a great boost to our hobby when only hams can find out about OSCAR.

All in all, another tidbit of information to remember the next time a League official lets loose some of that babble about your dues going toward more than just a magazine subscription. Phooey!

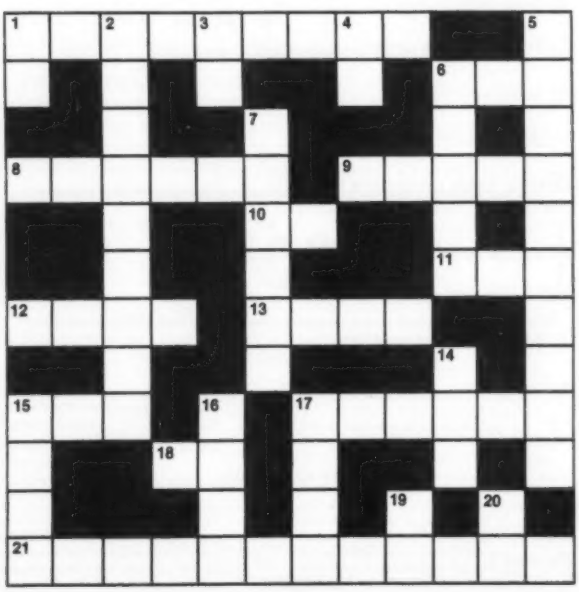


Illustration 1.

ELEMENT 1—CROSSWORD PUZZLE
(Illustration 1)

Across

1) Curves formed by the intersection of a cone with a plane parallel to its side.
6) Satellite TV preamp (abbr.)
8) TV bird
9) A TV distribution medium
10) Not color TV (abbr.)
11) Relative (abbr.)
12) Money: kilo _____
13) Satellite home video (abbr.)
15) Shorting buzz
17) Satellite TV "belt"
18) Our continent (abbr.)
21) User's end of satellite system (2 words)

Down

1) Board type (abbr.)
2) Another TV bird (2 words)
3) LNA transistor (abbr.)
4) Antenna mount: _____
5) Man-made moons
6) The human work needed to install a home satellite system
7) Satellite motions
14) Hobby video is entering a new _____
15) Rent a VCR
16) Composer you may hear on "Bravo"
17) Broadcaster's slang for a compact tape package
19) Antenna tuner (abbr.)
20) Yes opposite

ELEMENT 2—MULTIPLE CHOICE

1) Where did Howdy Doody live?

			1	I	2	H	3	D	4	A	5	F	6	B	7	E	8	D	9	C
10	I				11	C	12	J	13	G	14	J	15	B	16	K	17	A	18	C	19	H
20	G	21	F	22	F				23	B	24	K	25	C	26	B	27	I	28	J		
29	E	30	H	31	E	32	A	33	D	34	A	35	F			36	E	37	B	38	J
39	G			40	F	41	F	42	F	43	G			44	C	45	G	46	D		

Illustration 2.

1. Doodyland
2. Doodyville
3. Doodytown
4. Newington CT

2) Of the following television personalities, which one isn't (or wasn't) a ham?

1. Andy Devine
2. Arthur Godfrey
3. Dick Van Dyke
4. Stu Gillam

3) On *The Man From U.N.C.L.E.*, what was the name given to the communications link used by Napoleon Solo and Ilya Kuryakin?

1. Channel 19
2. Five-two direct
3. Interlink 12
4. Channel D

4) Who is ABC's science editor?

1. Hector Fuentes
2. Roy Neal
3. Jules Bergman
4. Murray Greshner

5) What is the present location of RCA's Satcom III?

1. Over the Pacific Ocean
2. Over the Atlantic Ocean
3. Over the Indian Ocean
4. Nobody knows

P	A	R	A	B	O	L	A	S			S			
C		C		P			Z		L	N	A			
		A			O				A		T			
W	E	S	T	A	R		C	A	B	L	E			
		A			B	W			O		L			
		T			I				R	E	L			
B	U	C	K		T	V	R	O			I			
		O			S				E		T			
H	U	M		B		C	L	A	R	K	E			
I			N	A		A			A		S			
R				C		R		A		N				
E	A	R	T	H	S	T	A	T	I	O	N			

Illustration 1A.

ELEMENT 3—TRUE-FALSE

	True	False
1) The first TV movie ever made starred Ronald Reagan.	_____	_____
2) Home Box Office is owned and operated by the *Washington Post* and *Newsweek*.	_____	_____
3) Of the estimated 3.9 million people who viewed the 1947 World Series on television, 3.5 million were situated in bars.	_____	_____
4) The "Overmyer Network" was a 1960s attempt at forming a fourth TV web.	_____	_____
5) The first experimental TV station was W2XBS.	_____	_____
6) There's no "Channel One" because the FCC forgot to allocate it.	_____	_____
7) The CBS system for color television would have required a mechanical disk rotating on the front of your TV picture tube.	_____	_____
8) Wayne Green once worked as a TV cameraman at WPIX-TV, Channel 11, in New York.	_____	_____
9) The first patent for a device that could send pictures by wire was granted to a German in 1919.	_____	_____
10) An episode of *Hazel* dealt with the problem of TVI. On this show, Mr. Baxter's reception of a golf telecast was ruined by a local ham.	_____	_____

ELEMENT 4—HAM ACROSTIC
(Illustration 2)

Guess the words defined and write them over the numbered dashes. Next, place each letter in the correct square in the puzzle. The black squares show word endings. The completed puzzle will form a statement relating to this month's topic.

A) VCR format..... 17 34 4 32

B) Signal interfaces..... 6 37 15 26 23

C) Goes with picture..... 25 44 18 9 11

D) TVRO antenna angle..... 46 8 3 33

E) Videotape "outs"..... 36 31 7 29

F) Satellite's job..... 40 5 35 42 41 21 2 2

G) What cable companies like to bring against pirates..... 43 45 20 39 13

H) International radio-TV body..... 30 19 2

I) Opera house seen on "Bravo"..... 1 27 10

J) TVRO setup can cost this..... 28 12 38 14

K) Iraq prefix..... 24 16

THE ANSWERS

Element 1:
See Illustration 1A.

Element 2:
1—2 There's no Doody in Newington.
2—3 But his agent is.
3—4 Remember? They had those little HTs that never seemed

to be limited in range or vulnerable to jammers.

4—3 Roy Neal works for NBC, Murray Greshner is the cop on *The Odd Couple* and I don't know who the heck Hector Fuentes is.

5—4 Satcom III (not to be confused with its replacement, Satcom IIIR) was lost shortly after launch. Nobody knows for sure where Satcom III is, but I understand they're watching some great movies up on Pluto.

Element 3:

1—True *The Killers*, in 1963. It was his last acting job—on screen, anyway.
2—False Time-Life.
3—True And make that a double, please.
4—True It didn't work.
5—True Operated by NBC in New York.
6—False There is a Channel One, but we call it "6 meters."
7—True The FCC thought RCA's all-electronic system was somewhat better.
8—True Smile.
9)—False Paul Nipkow was granted a German patent for such an instrument in *1884*!
10—True And I've got a recording of the program to prove it!

Element 4:

See Illustration 2A.

SCORING

Element 1:

Twenty-five points for the completed puzzle, or ½ point for each question correctly answered.

Element 2:

Five points for each correct answer.

Element 3:

Two and one-half points for each correct answer.

Element 4:

Twenty-five points for the completed puzzle, or one point for each correct answer.

So, do you know the difference between a plate and a dish?

1-20 points—Sees only snow
21-40 points—Dish pointed at Earth
41-60 points—Fuzzy picture
61-80 points—Sharp black and white picture
81-100 + points—Closed-circuit image

READER'S CORNER

Last January's puzzle concerning the five stations and their DX schedules provoked a sizable flurry of mail — some of it indignant. As a few of you discovered, there were actually *three* solutions to this puzzle. Here they are:

		M	U	L	T	I	P	O	I	N
T		D	I	S	T	R	I	B	U	T
I	O	N		S	Y	S	T	E	M	
P	I	R	A	T	E	S		D	O	N
T		M	I	S	S		O	U	T	

Illustration 2A.

	Name	Call	Working Now	Working Next
1.	Bob	W1WW	Korea	Mongolia
	Dan	W1YS	Mongolia	Hong Kong
	Jack	W1XT	Hong Kong	Japan
	Pat	W1BX	Japan	Taiwan
	Tom	W1JO	Taiwan	Korea
2.	Bob	W1WW	Taiwan	Mongolia
	Dan	W1YS	Mongolia	Hong Kong
	Jack	W1XT	Japan	Korea
	Pat	W1BX	Korea	Taiwan
	Tom	W1JO	Hong Kong	Japan
3.	Bob	W1WW	Taiwan	Mongolia
	Dan	W1YS	Mongolia	Hong Kong
	Jack	W1XT	Hong Kong	Japan
	Pat	W1BX	Korea	Taiwan
	Tom	W1JO	Japan	Korea

Gail Graham W5MLY worked out a beautiful Pascal program to solve this problem on a North Star Horizon computer. I wish I could print the run here, but it's much too long to fit within this column's limited space. I just wish to thank Gail on a magnificently executed job. And thanks, too, to everybody who wrote in.

Winners:

Found 3 solutions: Jerry Wetzel W3DMB, Gail A. Graham W5MLY.

Found 2 solutions: Mark E. Zaleski KA8BPY.

Found 1 solution: Michael S. Bilow N1BEE, Jim Connolly KA1UI, Harry D. Thomas KA1NH, Larry D. Peterson N2AMW, Hank Wellburn WA2JOX, John Wilcox KS4B, B. B. Jessee III N4DEK, Dallas W. Wilson KA6EOL, Roberta Horton KA7CUY, Daren Horton WB7VDJ, Richard C. Sowler W8FEM, Ricahrd C. Bonar WD8ORI, Kent S. Doub KF8Z, Daryl L. Waite K9JPQ, Bob Koelling KC0BL, Jerry Moore W0HMA.

Didn't find a solution, but either tried or made a puzzle comment: N2AMS, KA3IBI, WD4DAH, WD4ODS, WD9ATJ, KA9BAI, KA9KAW, KB9RR, KL7RA.

FCC

Reprinted from the Federal Register

Expansion of the Telephony Segments of the High Frequency Amateur Radio Service Bands

AGENCY: Federal Communications Commission.

ACTION: Notice of inquiry and proposed rule.

SUMMARY: The Commission proposes to make additional segments of the 14 MHz amateur band available for telephony operation. The Commission is also inquiring about making additional segments available for telephony operation in the other high frequency (HF) amateur bands (those amateur bands between 3 and 30 MHz). Congestion on the frequencies currently authorized for telephony use is causing the employment of this mode to become increasingly difficult. The proposed rules revision would help alleviate this situation in the 14 MHz band. The inquiry looks towards finding a suitable set of frequencies for telephony expansion in the other HF amateur bands.

DATES: File comments on or before July 1, 1982, and reply comments on or before August 2, 1982.

ADDRESS: Federal Communications Commission, Washington, DC 20554.

FOR FURTHER INFORMATION CONTACT: Steve Lett, Private Radio Bureau, (202) 832-7597.

SUPPLEMENTARY INFORMATION:

Adopted: February 11, 1982.

Released: February 24, 1982.

Introduction

1. Notice of Inquiry and Proposed Rule Making in the above-entitled matter is hereby given.

2. The Commission has before it at this time seven petitions for rule making which request that the Amateur Radio Service Rules (Part 97) be amended by provide for the use of telephony operation (emission types A3 and F3) on additional portions of the amateur high frequency (HF) bands—the bands between 3 and 30 MHz. Six of the petitions propose some particular portion of certain bands for additional telephony authorization. Four of the petitions propose that additional telephony privileges be divided among or limited to certain operator classes. The petitions are described in the following paragraphs.

3. RM-3705, submitted by Philip Galasso and received by the Commission on 18, 1980, requests that the frequencies 3750-3775 kHz, 7050-7100 kHz, 14100-14200 kHz, 21200-21250 kHz and 28200-28500 kHz be added to those authorized for telephony in the United States. It further requests that these additional telephony privileges only be granted to Amateur Extra Class operators and that power input during such operation be limited to 250 watts. The petition claims that expansion of frequencies for telephony operation is warranted due to congestion on the currently authorized telephony subbands and under-utilization by U.S. stations of the frequencies proposed for expansion. Lack of use by U.S. amateurs is attributed to incompatibility between telegraphy operation currently authorized for U.S. stations and telephony operation in common use by

foreign stations. Operator class and power restrictions are requested by the petition to help ". . . assure minimum interference to the existing radiotelephone users of these frequencies. . . ."

4. RM–3729, submitted by David Novos and received by the Commission on June 30, 1980, requests that the frequencies 7075–7100 kHz and 14175–14200 kHz be allocated for exclusive use by Amateur Extra Class licensees and that telephony operation be authorized on these frequencies. This petition also cites crowding on existing telephony subbands and incompatibility of domestic telegraphy operations with foreign telephony operations as reasons for expanding the telephony subbands. The petition further claims that protection for foreign amateurs from powerful U.S. stations is no longer necessary and that foreign stations, in fact, favor a subband expansion which would enable them to engage in an exchange of telephony communications with U.S. stations on a single frequency.

5. RM–3734, submitted by James Simon and William Bennett and received by the Commission on August 1, 1980, requests that the frequencies 3750–3775 kHz, 7050–7150 kHz, 14100–14200 kHz, 21200–21250 kHz and 28400–28500 kHz be made available for telephony use by U.S. amateurs. This petition again cites overcrowding on currently authorized telephony subbands and lack of further need for protection of foreign stations as reasons for its request.

6. RM–3778, submitted for the Willamette Valley DX Club by Robert Herndon and received by the Commission on October 7, 1980, requests that the frequencies 3750–3775 kHz, 7050–7100 kHz, 14100–14200 kHz, 21200–21250 kHz and 28400–28500 kHz be authorized for telephony operation since, it contends, "the United States no longer has the dominant amateur population and there is little reason to think that the expansion of U.S. amateur (telephony) privileges into previously reserved frequencies will result in undue hardship on foreign amateurs." The expansion is necessary, it claims, to relieve congestion on currently authorized telephony subbands.

7. RM–3831, submitted by Ronald Kramer and received by the Commission on November 7, 1980, petitions the Commission to increase the portion of each amateur frequency band between 1.8 and 30 MHz available for voice (telephony) communication and correspondingly decrease the portion of each band available for telegraphy communications. The petition claims this is necessary since the telephony mode is becoming increasingly popular.

8. RM–3833, submitted by Fred Huntley and received by the Commission on January 13, 1981, requests that "Extra Class Amateur Radio licensees be granted radiotelephone operation privileges between 7.100 and 7.150 MHz" and that "(s)uch operation be authorized a maximum power input of 250 watts." The petition proposes that this additional operation be on a shared basis with existing Novice class operations. Relief of congestion and interference on the existing telephony segment of that band is cited as necessitating this action.

9. RM–3860, submitted by the American Radio Relay League (ARRL) and received by the Commission on March 9, 1981, requests that the frequencies 14150–14200 kHz be added to those authorized for telephony use and that operator privileges on the revised telephony portions of the 14 MHz band be changed to the following: 14150–14175 kHz, Amateur Extra Class only; 14175–14225 kHz, Amateur Extra and Advanced Classes; 14225–14350 kHz, Amateur Extra, Advanced and General Classes. The petition cites growing congestion in the present telephony subbands as warranting expansion of the subbands. The operator privilege changes are proposed by the petition in the interest of lessening the impact of telephony subband expansion on foreign amateur operations.

Background

10. The Commission has traditionally designated particular portions of the heavily used HF amateur frequency bands for operation using certain emission modes, while only permitting other modes on different portions of the bands. These designations have served to segregate incompatible operating modes. Since the early days of radio, simultaneous use of incompatible modes on the same frequencies has worked to the mutual detriment of communications using all modes. Placing certain emission modes on different frequencies avoids this type of interference and has the further beneficial effect of indicating to amateur operators where, in the amateur bands, to seek out certain forms of operation.

11. The subband allocations [1] have also been arranged to protect international amateur radio operations. Foreign operators have consistently, in the past, objected to expansion of U.S. subbands for increasingly popular, wide bandwidth emissions such as telephony.[2] They have claimed that such an expansion would create a situation where high powered U.S. stations would overrun low power foreign stations and effectively prohibit the foreign stations from using those bands.

12. Protection of foreign stations has also benefited U.S. operators desiring to contact them using telephony. The U.S. operator can listen for the foreign stations in a portion of the band where strong U.S. signals are not present [3] and then reply on frequencies within the U.S. telephony subbands. The foreign operators then listen for the U.S. stations in the U.S. telephony subbands.[4]

13. Current regulations permit emission type A1 Morse telegraphy operation on all amateur radio frequencies. This unique universal authorization for that mode results from its character as an efficient and widely recognized communications language that can be employed with the simplest type of equipment. In the amateur 160 meter band (1800–2000 kHz) type A3 telephony operation is currently permitted on all frequencies. In all HF amateur bands roughly half of the band may be used for A3 or F3 telephony emissions. The limitations on telephony operation in most of the HF bands were instituted in order to prevent such operation from overwhelming telegraphy operations as well as to protect international operations. Type F1 digitally coded emissions (radioteletype) are permitted in all portions of the HF bands where telephony operation is not permitted since this type of operation is more harmonious with type A1 operation. The only other modes permitted on the HF bands, emission types A5 and F5 "slow-scan" television operation and emission types A4 and F4 facsimile operation, require a bandwidth approximately equivalent to telephony operation and consequently are permitted in the telephony subbands.[5] This current state of subband allocation in the HF amateur bands is the result of the Report and Order in the last proceeding dealing with expansion of the telephony subbands.[6]

14. Small portions of the various subband allocations are reserved for Amateur Extra Class and Advanced Class licensees. These portions were set aside to help provide an incentive for amateurs to upgrade their license operator class. This program of reserved operator privileges resulted from the proceeding dealing with incentive licensing and distinctive call signs.[7]

Proposal

15. The Commission proposes to expand telephony privileges in the 14 MHz amateur band by adding the frequencies 14150–14200 kHz to those currently authorized for such use. We feel this action is warranted due to the extreme congestion experienced by amateurs on the existing 14200–14350 kHz telephony subband. Although the various petitions' requests ranged from a subband that would start as low as 14100 kHz and extend to 14350 kHz, to a subband that would start as high as 14175 kHz and extend to 14350 kHz, we have selected a starting point of 14150 kHz to propose as a compromise between competing objectives. We anticipate that our proposal would provide substantial relief to the current overcrowding in the 14 MHz telephony subband while causing only a minimal disturbance to international operations. The increasing sophistication of equipment used by both foreign and domestic amateur operators leads us to believe that foreign stations should not experience undue interference from U.S. operations and that U.S. amateurs attempting to contact foreign stations should have less difficulty using single frequency operation (as opposed to "split operation") than they have had in the past. We propose retaining the frequencies 14100–14150 kHz for traditional weak signal and other international operations by not changing the modes authorized on those frequencies.

16. Since we do not anticipate a significant detrimental impact on international operations from our proposal, and since we desire to provide the maximum relief possible from the current overcrowding, we propose to make all of the additional telephony subband frequencies available to Amateur Extra Class, Advanced Class and General Class operators. To this end, we have specifically proposed to not change any of the operator privileges. However, we invite comments as to whether it would be desirable to delete from General Class operators the privileges between 14150 kHz and 14200 kHz, and instead, add privileges between 14225 kHz and 14275 kHz to those authorized for General Class operators. In this way, the telephony subbands available to General Class operators will be contiguous. Also, consistent with our action in PR Docket 80–252 to permit the use of television and facsimile on most portions of the HF bands where telephony is permitted, we propose to include the use of type A4, A5, F4 and F5 emissions in the new 14150–14200 kHz subband allocation. We are not proposing a stricter power limitation for the additional subband allocation since we do not feel this would make any significant contribution toward avoiding interference.

Inquiry

17. The 14 MHz amateur band has one of the two smallest telephony subband allocations and is, perhaps, the most popular HF amateur band due to its reliability for long distance communications. Because of these factors, we believe that crowding on this band is severe enough to transcend much of the controversy surrounding telephony subband expansion, and for this reason we have set forth a specific proposal for that band. However, we are not proposing expansion of any of the other telephony subbands between 3.5 and 29.7 MHz because we feel the issues involved are too inadequately defined for us to commit ourselves to any particular course of action. Instead, we invite the submission of comments and supporting information with which these issues may be clarified. The Commission recognizes that the existing telephony subbands are often seriously overcrowded. However, we request commenters to weigh the magnitude of this problem against the issues addressed in the following questions:

A. Would expansion of the telephony subbands have a major detrimental impact on domestic telegraphy operations?

B. Do non-U.S. stations still have a legitimate requirement to be protected, on some frequencies, from U.S. telephony operations?

C. Does the current trend toward the use of transceivers (with a common transmit and receive tuner) make the reservation of frequencies suitable for contacting foreign stations using "split operation" unnecessary or undesirable?

D. Should additional subband allocations for telephony be contiguous with the existing telephony subbands?

E. Would it be appropriate to relocate the existing Novice subbands to new frequencies within the same HF bands in order to make a telephony subband expansion more orderly?

F. Are the current exclusive subbands for Amateur Extra and Advanced Class operators sufficient to meet the goals of our incentive licensing program if all additional telephony frequencies are authorized to General as well as Amateur Extra and Advanced Class operators?

G. How should the recent expansion of the Canadian telephony subband in the 7 Mhz band influence proposals for a U.S. telephony expansion in the same band?

18. We also encourage commenters to make specific recommendations as to what frequencies would be best suited to use for additional telephony privileges and the relative occupancy of those frequencies. Comments about related matters not explicitly mentioned above are also invited.

Conclusion

19. Notice is hereby given that it is proposed to amend 47 CFR Part 97 in accordance with the proposals set forth in the attached Appendix. Notice is also given of inquiry into the matter discussed above.

Procedural Matters

20. For purposes of this non-restricted notice and comment rule making proceeding, members of the public are advised that *ex parte* contracts are permitted from the time the Commission adopts a notice of proposed rule making until the time a public notice is issued stating that a substantive disposition of the matter is to be considered at a forthcoming meeting or until a final order disposing of the matter is adopted by the Commission, whichever is earlier. In general, an *ex parte* presentation is any written or oral communication (other than formal written comments/pleadings and formal oral arguments) between a person outside the Commission and a Commissioner or a member of the Commission's staff which addresses the merits of the proceeding. Any person who submits a written *ex parte* presentation must serve a copy of that presentation on the Commission's

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[1] The term "subband" is popularly used to describe a segment of a frequency band where authorized modes of emission or authorized operator class privileges are different from those in other portions of the same band. This term is used throughout the text for the sake of clarity.

[2] Depending on the specific emission mode employed, telephony operations in the HF amateur bands occupy a bandwidth roughly between 3 kHz and 7kHz. The more popular telephony modes in use today (principally A3J single sideband) occupy somewhat less than 4 kHz. On the other hand, telegraphy emissions used in the HF bands (both A1 and F1 types) occupy less than 1 kHz.

[3] This portion of a band, where domestic telephony operation is not permitted and where operators listen for foreign stations to contact, is commonly known as the "DX window."

[4] This form of operation where an amateur transmits to a station on one frequency and listens for the station's reply on another frequency is commonly known as "split frequency operation."

[5] Authorization of emission types A5 and F5 "slow-scan" television operation, along with types A4 and F4 facsimile operation, in entire HF telephony subbands was the subject of the proceeding in PR Docket 80–252. See Report and Order, 47 FR 2872, January 20, 1982.

[6] Report and Order in Docket 19162, 37 FR 21325, October 7, 1972.

[7] Report and Order in Docket 15928, 32 FR 12882, September 1, 1967.

Secretary for inclusion in the public file. Any person who makes an oral *ex parte* presentation addressing matters not fully covered in any previously-filed written comments for the proceeding must prepare a written summary of that presentation; on the day of oral presentation, that written summary must be served on the Commission's Secretary for inclusion in the public file, with a copy to the Commission official receiving the oral presentation. Each *ex parte* presentation described above must state on its face that the Secretary has been served, and must also state by docket number the proceeding to which it relates. See generally, Section 1.1231 of the Commission's rules, 47 CFR 1.1231. A summary of the Commission's procedures governing *ex parte* contacts in informal rule makings is available from the Commission's Consumer Assistance Office, FCC, Washington, DC 20554, (202) 632–7000.

21. Authority for issuance of this Notice is contained in Sections 4(i), 303(r) and 403 of the Communications Act of 1934, as amended, 47 U.S.C. 154(i), 303(r) and 403. Pursuant to applicable procedures set forth in Section 1.415 of the Commission's Rules, interested persons may file comments on or before July 1, 1982, and reply comments on or before August 2, 1982. All relevant and timely comments will be considered by the Commission before final action is taken in this proceeding. In reaching its decision, the Commission may take into consideration information and ideas not contained in the comments, provided that such information or a writing indicating the nature and source of such information, is placed in the public file, and provided that the fact of the Commission's reliance on such information is noted in the Report and Order.

22. In accordance with § 1.419 of the Commission's rules, 47 CFR 1.419, formal participants must file an original and five copies of their comments and other materials. Participants who wish each Commissioner to have a personal copy of their comments should file an original and eleven copies. Members of the general public who wish to express their interest by participating informally may do so by submitting one copy. All comments are given the same consideration, regardless of the number of copies submitted. All documents will be available for public inspection during regular business hours in the Commission's Public Reference Room at its headquarters in Washington, DC.

23. The Commission has determined that Sections 603 and 604 of the Regulatory Flexibility Act of 1980 (Pub. L. 96-354) do not apply to this rule making proceeding since the proposed rules would only change operating practice. These changes would not compel amateur operators to purchase new equipment and consequently would have no significant economic impact on them or any small businesses, small organizations or small governmental jurisdictions.

24. It is ordered that the Secretary shall cause a copy of this Notice to be served upon the Chief Counsel for Advocacy of the Small Business Administration and that the Secretary shall also cause a copy of this Notice to be published in the **Federal Register**.

25. For further information on this proceeding contact Steve Lett, Federal Communications Commission, Private Radio Bureau, Washington, DC 20554, (202) 632-7597.

(Secs. 4, 303, 307, 48 Stat., as amended, 1066, 1082, 1083; 47 U.S.C. 154, 303, 307)

Federal Communications Commission.
William J. Tricarico,
Secretary.

Appendix

PART 97—AMATEUR RADIO SERVICE

It is proposed that paragraph (a) of § 97.61 of the Commission's Rules and Regulations, 47 CFR 97.61, be amended as follows:

In the table in that paragraph, the row beginning with "14200–14350 (kHz)" would be revised by beginning the row with "14150–14350 (kHz)" so that the entire row reads as follows:

* * * * *

14150–14350 ..... A3, A4, A5, F3, F4, F5

§ 97.61 (Amended)

HAM HELP

Does anyone have information on the whereabouts of VP6LX (April, 1963) or W2PCJ/KJ6 (August, 1963)?

George Oster K9EDA
524 6th St.
West Des Moines IA 50265

Can anyone suggest a cure for the rf feedback coming out of my TS-130's headphones and speaker when I use 10-meter phone?

Marvin Rosen N3BQA
20 W. Madison St.
Baltimore MD 21201
(301)-685-6308

I would like to hear from collectors of antique radios.

Ed Best AK4W
2004 University Dr.
Durham NC 27707
(919)-489-2164

I am looking for any information on changes that can be done to a Heathkit HW-101 to better its performance or add extra features.

Gary Johnson WD8SDO
6616 Maplewood Ave.
Sylvania OH 43560
(419)-882-0121

I would like to have a copy of the manual, circuit diagram, and crystal information on the Standard SR-C146 two-meter handheld transceiver.

Dennis Sladen VE1BZJ
Site 16A Box 4, RR#4
Armdale B3L 4J4
Nova Scotia, Canada

I am in need of a schematic, manual, and alignment instructions for an E. H. Scott Laboratories AN/SRR-3 WWII Navy receiver.

Cal Cotner K4JSI
5324 N. 27th St.
Arlington VA 22207

CORRECTIONS

"The Masher," an article in the March, 1982, issue of *73*, has a capacitor incorrectly labeled. C3 in Fig. 2 and on the parts list should be a 1-uF capacitor.

Power Gain Systems' new product announcement in the March, 1982, *73* had an incorrect phone number. Power Gain Systems can be reached at (318)-325-4754. Since publishing the prices for the coaxial dipole, *73* has learned that the antennas now list for $44.95 and $49.95.

Tim Daniel N8RK
***73 Magazine* Staff**

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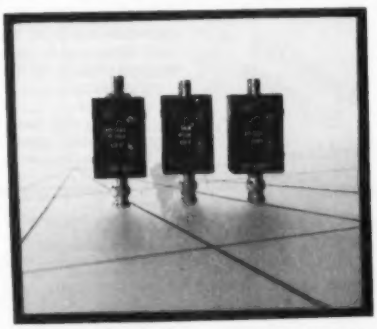

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SOCIAL EVENTS

from page 105

include door prizes every hour, indoor vendors, a flea market, and nets and group meetings. Food and drink will be available. Talk-in on 146.19/.79 and 147.86/.26. For further information, write Jack R. Thompson KA4RKS, 637 Wolf Road, Covington KY 41015, or call (606)-291-2153.

MUNCIE IN
MAY 23

The 3rd annual Muncie Area Amateur Radio Club Hamfest will be held on May 23, 1982, from 8:00 am to 3:00 pm at the Ball State University indoor track building, Muncie IN. Tickets are $2.00 in advance or $3.00 at the door. All activities are under a roof and there will be forums, prizes, refreshments, and parking available. Flea market tables are $4.00 on a first-come basis, and setup will be 6:00 pm to 1:00 am on Saturday and 6:00 am to 7:45 am on Sunday. Talk-in on 146.13/.73, 146.52, and 223.10/24.70. For further information, contact Terry Evans WD9HQH, 522 S. Brotherton, Muncie IN 47302, or phone (317)-282-0615.

FREETOWN MA
MAY 23

The Fall River Amateur Radio Club will hold its flea market on Sunday, May 23, 1982, from 10:00 am to 4:00 pm at the American Legion Hall, Freetown MA. Admission is $1.00 and flea market spaces are $7.00 in advance or $9.00 at the door (the table price includes 2 admissions). Free coffee will be available. Talk-in on 147.63/.03 and .52. For space reservations, send a check payable to Fall River Amateur Radio Club to Ann M. Carro KA1DNB, 652 Old Colony Terrace, Tiverton RI 02878.

GEORGETOWN IL
MAY 23

The 13th annual Danville Area Hamfest will be held on May 23, 1982, at the fairgrounds in Georgetown IL. The gates will open at 6:00 am. Adult tickets are $2.50 in advance and $3.00 at the gate; children under 14 years of age will be admitted free. There will be a free outdoor flea market area (please bring your own tables, chairs, and power cords). The indoor area will be available at additional cost. Overnight camping, with or without water and electrical hookups, is $5.00 per vehicle per night. Activities will include door prize drawings, family entertainment, forums, and much more. Refreshments, free coffee, and free parking will be available. Talk-in on 146.22/.82 and 146.52. For more information on tickets and/or tables, contact Wendell Lyons KA9AYS, Hamfest Chairman, 903 Polk Street, Danville IL 61832 or phone (217)-431-2124.

PITTSBURGH PA
MAY 23

The 28th annual Breeze Shooters Hamfest will be held on May 23, 1982, from noon to 5:00 pm at the White Swan Park, Rte. 60 (Parkway West), near the Greater Pittsburgh International Airport, Pittsburgh PA. Registration is $2.00 or three for $5.00. Activities are a free flea market, prizes, a CW contest, and a family amusement park. Sheltered tables for vendors are available by advance registration only. Talk-in on 146.28/.88 or 29.0. For further information, contact Joe Kyler K3SJD, 4430 Evergreen Road, Pittsburgh PA 15214, or phone (412)-931-2756.

PARAMUS NJ
MAY 23

The Bergen Amateur Radio Association will hold a Swap 'n Sell on May 23, 1982, from 8:00 am to 4:00 pm at Bergen Community College, 400 Paramus Road, Paramus NJ. Buyers will be admitted free. There will be tailgating only and spaces are $3.00 (bring your own tables). For more information, contact Jim Greer KK2U, 444 Berkshire Road, Ridgewood NJ 07450, or phone (201)-445-2855.

FREMONT OH
MAY 23

The Ohio Radio Club and the Ottawa County Amateur Radio Club will hold a hamfest on May 23, 1982, at the fairgrounds in Fremont OH. Dealers may set up at 7:00 am and gates will open at 8:00 am. Advance tickets are $2.50 and $3.00 at the door. Talk-in on .31/.91 and .52. For table reservations and tickets, send an SASE to John Dickey W8CDR, 545 N. Jackson Street, Fremont OH 43420.

WEST FRIENDSHIP MD
MAY 30

The Maryland FM Association will hold its annual hamfest on Sunday, May 30, 1982, from 8:00 am to 4:00 pm at the Howard County Fairgrounds, West Friendship MD (about 30 miles west of Baltimore). Admission is a $3.00 donation, tailgating is $3.00, advance reserved tables are $6.00 each, and tables at the hamfest will be $10.00. Talk-in on 146.16/.76 and .52. For more information, write MFMA Hamfest Committee, Post Office, Harmans MD 21077. For table information and reservations, contact John Elgin WA3MNN, 5495 Apt. 2, Harpers Farm Road, Columbia MD 21044, or phone (301)-596-3741.

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received two months prior to the month in which the event takes place.

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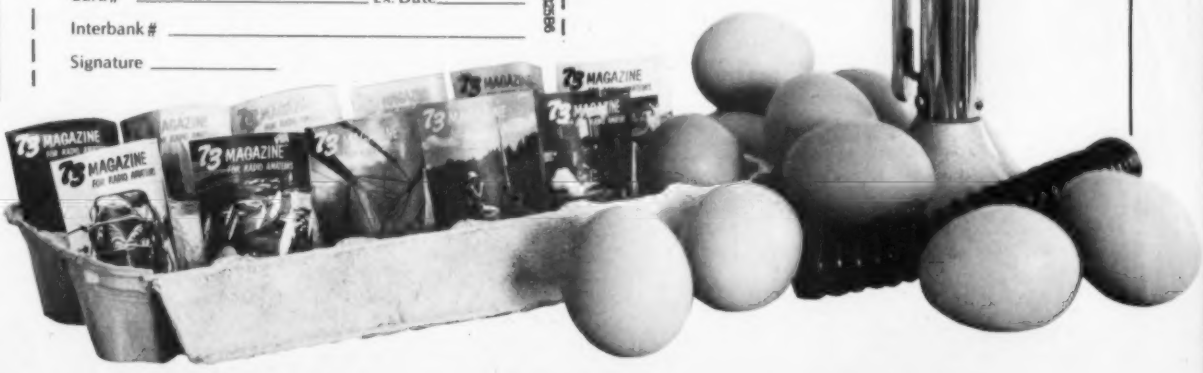

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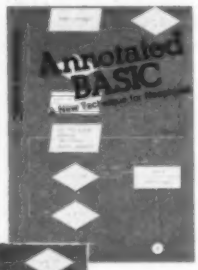

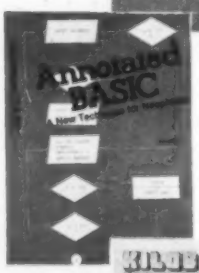

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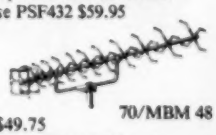

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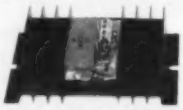

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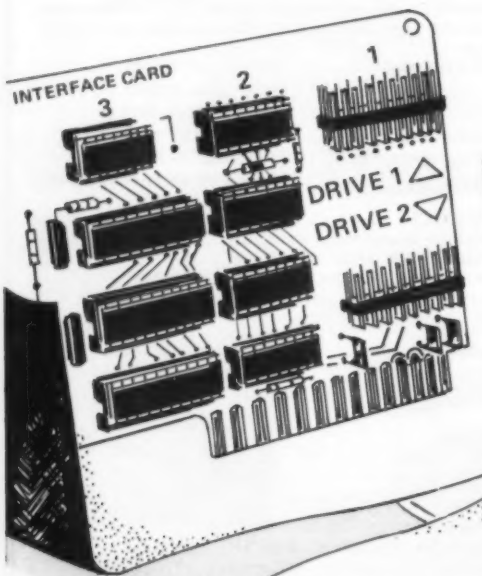

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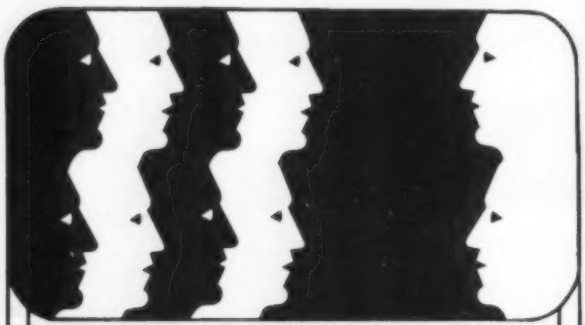

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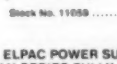

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11204	18	.24	.21	.19
11205	20	.27	.24	.21
11206	22	.30	.26	.23
11207	24	.33	.30	.25
11208	28	.38	.34	.29
11209	40	.53	.45	.40

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13806	24	0.75A	4-7/16x4x2	38.00
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44012	CD4011UBE	.36	.33
44013	CD4013BE	.56	.52
44015	CD4015BE	1.07	1.01
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44017	CD4017BE	1.07	1.01
44019	CD4019BE	.69	.65
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44024	CD4024BE	.92	.87
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13838	3.0-7.0	15±0.7	0-20	.48x.51x3.05	7.00
13829	3.0-7.0	28±0.7	0-10	.48x.51x3.05	7.00
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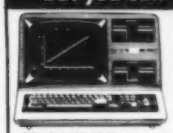

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Assembled—$24.95 Kit—$14.95

TR-9000 Memory Scanner
for Kenwood TR-9000 scans 5 memory channels. Stops on busy and resumes when carrier drops. Uses existing controls, No switches to add. Installs easily inside rig. See product review Sept. issue *73 Magazine*.
Assembled—$39.95

IC-280 Band Scanner—$29.95
Memory Scanner—$39.95 both for $59.90
* Scanners do not affect normal rig operation.
* Digital readouts display scanned frequency.
* All scanners are easy to install using complete and detailed installation instructions.
* All scanners ASSEMBLED & TESTED (except kit)
* Satisfaction Guaranteed!

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include $1.50 postage & handling
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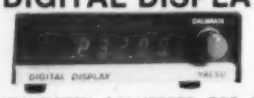

NEW YAESU CONVERTED FOR FT10 FR101 TS520 TS900. PLUG INTO EXTERNAL VFO JACK AND GO. 5 ACTIVE DIG TO 10HZ. REAR PANEL 10HZ DEFEAT SWITCH. 3/8" RED LED. 1 3/8H. 4 1/2 W. 6 1/2.
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AUTO SCAN MODULE AND BATTERY SAVER KIT

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15 minutes to install; scan restarts when carrier drops off; busy switch controls automatic scan on-off; includes module and instructions.
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new

FT-207R BATTERY SAVER KIT
MODEL BS-1 $14.95
*No more dead batteries due to memory back-up
*30% less power drain when squelched
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*45 mA receiver drain reduced to 30 mA.
*Improved audio fidelity and loudness

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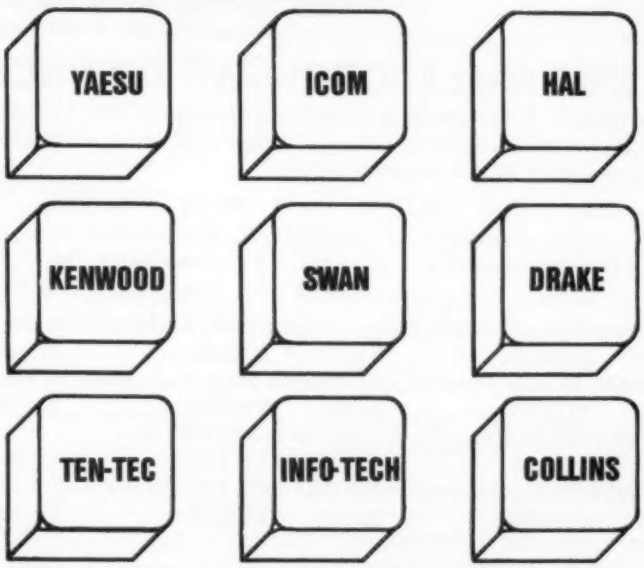

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MHz electronics

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2111 W. CAMELBACK ROAD
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Introducing

TVRO CIRCUIT BOARDS

Satellite Receiver Boards—Now in Stock

DUAL CONVERSION BOARD.....**$25.00**
This board provides conversion from the 3.7-4.2 band first to 900 MHz where gain and bandpass filtering are provided and, second, to 70 MHz. The board contains both local oscillators, one fixed and the other variable, and the second mixer. Construction is greatly simplified by the use of Hybrid IC amplifiers for the gain stages.

SIX 47pF CHIP CAPACITORS
For use with dual conversion board.....**$6.00**

70 MHz IF BOARD.....**$25.00**
This circuit provides about 43dB gain with 50 ohm input and output impedance. It is designed to drive the HOWARD/COLEMAN TVRO Demodulator. The on-board bandpass filter can be tuned for bandwidths between 20 and 35 MHz with a passband ripple of less than ½ dB. Hybrid IC's are used for the gain stages.

SEVEN .01 pF CHIP CAPACITORS
For use with the 70 MHz IF board.....**$7.00**

DEMODULATOR BOARD.....**$40.00**
This circuit takes the 70 MHz center frequency satellite TV signals in the 10 to 200 millivolt range, detects them using a phase locked loop, de-emphasizes and filters the result and amplifies the result to produce standard NTSC video. Other outputs include the audio subcarrier, a DC voltage proportional to the strength of the 70 MHz signal, and AFC voltage centered at about 2 volts DC.

SINGLE AUDIO.....**$15.00**
This circuit recovers the audio signals from the 6.8 MHz frequency. The Miller 9051 coils are tuned to pass the 6.8 MHz subcarrier and the Miller 9052 coil tunes for recovery of the audio.

DUAL AUDIO.....**$25.00**
Duplicate of the single audio but also covers the 6.2 range.

DC CONTROL.....**$15.00**

SPECIAL SET OF FIVE BOARDS.....**$100.00**
INCLUDING DUAL AUDIO (2 single audio boards)

1900 to 2500 MHz MICROWAVE DOWNCONVERTER

MICROWAVE RECEIVER This receiver is tunable over a range of 1900 to 2500 MHz approximately, and is intended for amateur use. The local oscillator is voltage controlled, making the I.F. range approximately 54 to 88 MHz for standard TV set channels 2 thru 7.

P.C. BOARD with DATA 1 to 5 **$15.00** 6 to 11 **$13.00** 12 to 26 **$11.00** 27-up **$9.00**

P.C. Board with all parts for assembly.....**$49.99**
P.C. Board with all parts for assembly plus 2N6603.....**$69.99**
P.C. Board with all chip caps soldered on...**$30.00**
P.C. Board assembled & tested.....**$69.99**
P.C. Board assembled & tested with 2N6603**$79.99**

HMR II DOWNCONVERTER with Power Supply, Antenna (Dish) & all Cables for installation. 180 Day Warranty.
1 to 5 **$150.00** 6 to 11 **$140.00** 12-up **$125.00**

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YAGI DOWNCONVERTER as above but Kit. (NO CABLES) With Box.
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HMR II DOWNCONVERTER as above but Kit. (NO CABLES) With PVC.
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SPECIAL NEW STOCK OF CARBIDE DRILL BITS—YOUR CHOICE $1.99

1.25mm	13/64	36	47	55	63
1.45mm	19	37	48	56	64
3.2mm	20	38	49	57	65
3.3mm	24	39	50	58	67
1/8	26	40	51	59	68
3/16	29	44	52	60	69
5/32	30	45	53	61	
7/32	31	46	54	62	

Start taking calls in curious places with the revolutionary, new Cordless *Escort*® Phone.

Special Purchase—The *Escort*® Cordless Telephone!

We are pleased to announce the Escort Mark III is now available at special pricing. We bought the manufacturer's entire inventory-- and we are passing the savings on to you!

The Escort Mark III was originally designed to retail for $199.95. Now, we suggest a retail price of $169.95 to $189.95. Or, you can move them out at $149.95. In any event, you'll like the profit margins.

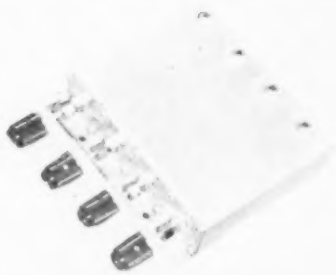
QUANTITY	*DEALER PRICE*	*GROSS PROFIT AT $149.95*
1—2 units	69.75 each	53%
3—5 units	64.50 each	57%
6—11 units	62.50 each	58%
12—23 units	60.75 each	59%

On all orders of 12 or more, we pay the freight! This is your opportunity to stock up for the Christmas buying season. These are ideal gift items, that will really move out!

ESCORT MARK III SPECIFICATIONS

VHF DUPLEXERS

This duplexer was made for RF Harris Mobile Phones and Two Way Radios. These duplexers can be used in any mobile phone or two way radio system, along with having the capabilities to be modified for UHF use. The physical dimensions are 3 3/5" Long, 4 2/5" Wide, and 1 1/10" Deep. The approximate weight is 18 oz./1 lb. 2 oz.. PRICE **$74.99**



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- High-performance antenna
- Full duplex, answer and dial out
- Full FCC approval

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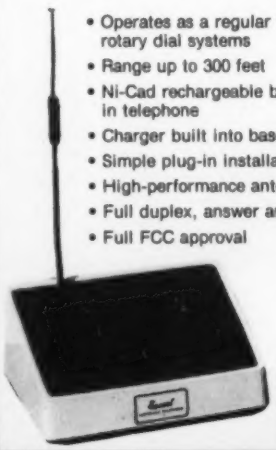

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The new Cordless Phone works on a simple, highly sophisticated principle. A small base station plugs into your regular phone jack, and an electrical wall outlet. The base station then transmits any in- or out-going call to the handheld receiver, anywhere up to 300 feet.

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MHz electronics

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"FILTERS"

Collins Mechanical Filter #526-9724-010 Model F455Z32F
455KHz at 3.2KHz Wide. $15.00

Atlas Crystal Filters

5.52-2.7/8	5.52MHz/2.7KHz wide 8 pole	
5.595-2.7/8/U	5.595MHz/2.7KHz wide 8 pole upper sideband	
5.595-.500/4/CW	5.595MHz/.500KHz wide 4 pole CW	
5.595-2.7/LSB	5.595MHz/2.7KHz wide 8 pole lower sideband	
5.595-2.7/USB	5.595MHz/2.7KHz wide 8 pole upper sideband	
5.645-2.7/8	5.645MHz/2.7KHz wide 8 pole	Your Choice
9.0SB/CW	9.0MHz/ 8 pole sideband and CW	$12.99

Kokusai Electric Co. Mechanical Filter #MF-455-ZL-21H
455KHz at Center Frequency of 453.5Kc Carrier Frequency of 455Kc 2.36Kc Bandwidth $15.00

Crystal Filters

Nikko	FX-07800C	7.8MHz	10.00
TEW	FEC-103-2	10.6935	10.00
Tyco/CD	001019880	10.7MHz 2 pole 15KHz Bw. Motorola #48D84396K01 Thru #48D84396K05	4.00
Motorola	4884863B01	11.7MHz 2 pole 15KHz Bandwidth	5.00
PTI	5350C	12MHz 2 pole 15KHz Bandwidth	5.00
PTI	5426C	21.4MHz 2 pole 15KHz Bandwidth	5.00
CD	A10300	45MHz 2 pole 15KHz Bandwidth (For Motorola Communications equipment)	5.00

Ceramic Filters

Murata	BFB455B	455KHz	$ 2.40
	CFM455E	455KHz +- 5.5KHz	6.65
	CFM455D	455KHz +- 7KHz	6.65
	CFR455E	455KHz +- 5.5KHz	8.00
	CFU455E	455KHz +- 1.5KHz	2.90
	CFU455G	455KHz +- 1KHz	2.90
	CFW455D	455KHz +- 1KHz	2.90
	CFW455H	455KHz +- 3KHz	4.35
	SFB455D	455KHz	2.40
	SFE10.7	10.7MHz	2.67
	SFG10.7MA	10.7MHz	10.00
Clevite	TO-01A	455KHz	5.00
	TO-02A	455KHz	5.00
Nippon	LF-B4/CFU455I	455KHz +- 1KHz	5.80
	LF-B6/CFU455H	455KHz +- 1KHz	5.80
	LF-C18	455KHz	10.00
Tokin	CF455A/BFU455K	455KHz +- 2KHz	4.80
Matsushira	EFC-L455K	455KHz	7.00

ROTRON MUFFIN FANS Model Mark 4/MU2A1
These fans are new factory boxed 115vac at 14watts 50/60cps. Impedance Protected-F
CFM is 88 at 50cps and 105 at 60cps. $ 7.99

SPECTRA PHYSICS INC. Model 088 HeNe Laser Tubes.
Power output 1.6mw. Beam Dia. .75mm. Beam Dir. 2.7mr. 8Kv starting voltage
68K ohm 1watt ballast 1000vdc +-100vdc 3.7ma. TUBES ARE NEW $59.99

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AVANTEK LOW NOISE AMPLIFIERS

Models	UTC2-102M	AP-20-T	AL-45-0-1	AK-1000M
Frequency Range	30 to 200MC	200 to 400MC	450 to 800MC	500 to 1000MC
Noise Figure	1.5dB	6.5dB	7dB	2.5dB
Voltage	+15vdc	+24vdc	-6vdc @ +12vdc	+12vdc @ -12vdc
Gain	29dB	30dB	30dB	25dB
Power Output	1dB Gain +7dBm	1dB Gain +20dBm	1dB Gain -5dBm	1dB Gain +8dBm
Price	$49.99	$49.99	$49.99	$69.99

Mini Circuits Double Balanced Mixers

Model RAY-3
Very High Level (+23dBm LO) 70KHz to 200MHz LO,RF,DC to 200MHz IF
Conversion Loss,dB One Octave From Band Edge 6Typ./7.5Max. Total Range 6.5Typ./8Max.
Isolation,dB Lower Band Edge To One Decade Higher (LO-RF/LO-IF) 55Typ./45Min. Mid. Range (LO-RF/LO-IF) 40Typ./30Min. Upper Band Edge To One Octave Lower (LO-RF/LO-IF) 30Typ./25Min.
Price $24.99

Model TSM-3
Standard Level (+7dBm LO) .1MHz to 400MHz LO,RF,DC to 400MHz IF
Conversion Loss,dB One Octave From Band Edge 5.3Typ./7.5Max. Total Range 6.5Typ./8.5Max.
Isolation,dB Lower Band Edge To One Decade Higher (LO-RF/LO-IF) 60Typ./50Min. Mid. Range (LO-RF/LO-IF) 50Typ./35Min. Upper Band Edge To One Octave Lower (LO-RF/LO-IF) 35TYP./25Min.
Price $11.99

Hewlett Packard Linear Power Microwave RF Transistor HXTR5401/35831E

Collector Base Brakedown Voltage at Ic=100ua	35volts min.
Collector Emitter Brakedown Voltage at Ic=500ua	30volts min.
Collector Cutoff Current at Vcb=15v	100ua max.
Forward Current Transfer Ratio at Vce=15v,Ic=15ma	15min,40typ,125max
Transducer Power Gain at Vce=18v,Ice=60ma,F=2GHz.	3dBmin,4dBtyp
Maximum Available Gain at Vce=18v,Ic=60ma,F=1GHz/F=2GHz	14dB typ,8dB typ
Price	$29.99

Motorola RF Power Amplifier Modules

Model	MHW612A	MHW613A	MHW710	MHW720
Frequency Range	146 to 147MHz	150 to 174MHz	400 to 512MHz	400 to 470MHz
Voltage	12.5vdc	12.5vdc	12.5vdc	12.5vdc
Output Power	20watts	30watts	13watts	20watts
Minimum Gain	20dB	20dB	19.4dB	21dB
Harmonics	-30dB	-30dB	40dB	40dB
RF Input Power	400mw	500mw	250mw	250mw
Price	$57.50	$59.80	$57.50	$69.00

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MHz electronics

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"TRANSISTORS"

WATKINS JOHNSON WJ-M62 3.7 to 4.2GHz Communication Band Double Balanced Mixer $100.00

SSB Conversion Loss	4.9dB Typ. 6dB Max.	fR 3.7 to 4.2GHz	
	5.5dB Typ. 6.5dB Max.	fI DC to 1125MHz fL fR	
		fI 880MHz fL fR	
SSB Noise Fiqure		fR 3.7 to 4.2GHz	
	4.9dB Typ. 6dB Max.	fI 30 to 1125MHz fL fR	
	5.5dB Typ. 6.5dB Max.	fI 880MHz fL fR	
Isolation			
fL at R	30dB Min. 40dB Typ.	fL 2.8 to 5.35GHz	
fL at I	25dB Min. 30dB Typ.	fL 4.5 to 5.35GHz	
	20dB Min. 30dB Typ.	fL 3.6 to 4.5GHz	
	15dB Min. 25dB Typ.	fL 2.8 to 3.6GHz	
Conversion Compression	1dB Max.	fR Level +2dBm	
Flatness	.2dB Peak to Peak Over any 40MHz Segment of fR=3.7 to 4.2GHz		
Third Order Input Intercept	+11dBm	fR1=4GHz fR2=4.01GHz Both at -5dBm fL=4.5GHz	
Group Time Delay	.5ns Typ. .75ns Max.	fR3.7 to 4.2GHz fL 3480MHz	@ +13dBm
VSWR	L-Port 1.25:1 Typ.	2.0:1	fL 2.8 to 5.35GHz
	R-Port 1.25:1 Typ.	2.0:1	fR 3.7 to 4.2GHz fL fR
	1.4 :1 Typ.	2.0:1	fR 3.7 to 4.2GHz fL fR
	I-Port 1.5 :1 Typ.	2.0:1	fI=100MHz
	1.3 :1 Typ.	2.0:1	fI=500MHz
	1.8 :1 Typ.	2.5:1	fI=1125MHz

SGS/ATES RF Transistors			Motorola RF Transistor	
Type.	BFQ85	BFW92	MRF901	2N6603
Collector Base V	20v	25v	25v	25v
Collector Emitter V	15v	15v	15v	15v
Emitter Base V	3v	2.5v	3v	3v
Collector Current	40ma	25ma	30ma	30ma
Power Dissipation	200mw	190mw	375mw	400mw
HFE	40min. 200max.	20min. 150max.	30min. 200max.	30min. 200max.
FT	4GHZ min. 5GHz max.	1.6GHz Typ.	4.5GHz typ.	2GHz min.
Noise Fiqure	1GHz 3dB Max.	500MHz 4dB Typ.	1GHz 2dB Typ.	2GHz 2.9dB Typ.
Price	$1.50	$1.50	$2.00	$10.00

National Semiconductor Variable Voltage Regulator Sale !!!!!!!!!

LM317K	LM350K	LM723G/L	LM7805/06/08/12/15/18/24
1.2 to 37vdc	1.2 to 33vdc	2 to 37vdc	5, 6, 8,12,15,18,24vdc
1.5Amps	3Amps	150ma.	1Amp
TO-3	TO-3	TO-100/TO-116	TO-220/TO-3
$4.50	$5.75	$1.00 $1.25	$1.17 $2.00

P & B Solid State Relays Type ECT1DB72
5VDC Turn On 120VAC Contact 7Amps
20Amps on 10"x10"x.062" Alum.Heatsink with
Silicon Grease $5.00

*May Be Other Brand Equivalent

Toll Free Number
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"MIXERS"

WATKINS JOHNSON WJ-M6 Double Balanced Mixer

LO and RF 0.2 to 300MHz	IF DC to 300MHz	$21.00
Conversion Loss (SSB)	6.5dB Max. 1 to 50MHz 8.5dB Max. .2 to 300MHz	WITH DATA SHEET
Noise Figure (SSB)	same as above 8.5dB Max. 50 to 300MHz	
Conversion Compression	.3dB Typ.	

NEC (NIPPON ELECTRIC CO. LTD. NE57835/2SC2150 Microwave Transistor

NF Min F=2GHz	dB 2.4 Typ.	MAG F=2GHz	dB 12 Typ.	$5.30
F=3GHz	dB 3.4 Typ.	F=3GHz	dB 9 Typ.	
F=4GHz	dB 4.3 Typ.	F=4GHz	dB 6.5 Typ.	

Ft Gain Bandwidth Product at Vce=8v, Ic=10ma. GHz 4 Min. 6 Typ.
Vcbo 25v Vceo 11v Vebo 3v Ic 50ma. Pt. 250mw

UNELCO RF Power and Linear Amplifier Capacitors

These are the famous capacitors used by all the RF Power and Linear Amplifier manufacutures and described in the Motorola RF Data Book.

10pf	22pf	30pf	40pf	100pf	250pf	1 to 10pcs. .60¢ each
13pf	25pf	32pf	43pf	120pf	820pf	11 to 50pcs. .50¢ each
14pf	27pf	33pf	62pf	180pf		51 to 100pcs. .40¢ each
20pf	27.5pf	34pf	80pf	200pf		

NIPPON ELECTRIC COMPANY TUNNEL DIODES $7.50

		MODEL 1S2199	1S2200
Peak Pt. Current ma.	Ip	9min. 10Typ. 11max.	9min. 10Typ. 11max.
Valley Pt. Current ma.	Iv	1.2Typ. 1.5max.	1.2Typ. 1.5max.
Peak Pt. Voltage mv.	Vp	95Typ. 120max.	75Typ. 90max.
Projected Peak Pt. Voltage mv.	Vpp Vf=Ip	480min. 550Typ. 630max.	440min. 520Typ. 600max.
Series Res. Ohms	rS	2.5Typ. 4max.	2Typ. 3max.
Terminal Cap. pf.	Ct	1.7Typ. 2max.	5Typ. 8max.
Valley Pt. Voltage mv.	VV	370Typ.	350Typ.

FAIRCHILD / DUMONT Oscilloscope Probes Model 4290B

Input Impedance 10 meg., Input Capacity 6.5 to 12pf., Division Ration (Volts/Div Factor) 10:1, Cable Length 4Ft. , Frequency Range Over 100MHz.
These Probes will work on all Tektronix, Hewlett Packard, and other Oscilloscopes.

PRICE $45.00

MOTOROLA RF DATA BOOK

List all Motorola RF Transistors / RF Power Amplifiers, Varactor Diodes and much much more.

PRICE $7.50

Toll Free Number
800-528-0180
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MHz electronics

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"SOCKETS AND CHIMNEYS"

EIMAC TUBE SOCKETS AND CHIMNEYS

SK110	Socket	$ POR	SK626	Chimney	$ 7.70
SK406	Chimney	35.00	SK630	Socket	45.00
SK416	Chimney	22.00	SK636B	Chimney	26.40
SK500	Socket	330.00	SK640	Socket	27.50
SK506	Chimney	47.00	SK646	Chimney	55.00
SK600	Socket	39.50	SK711A	Socket	192.50
SK602	Socket	56.00	SK740	Socket	66.00
SK606	Chimney	8.80	SK770	Socket	66.00
SK607	Socket	43.00	SK800A	Socket	150.00
SK610	Socket	44.00	SK806	Chimney	30.80
SK620	Socket	45.00	SK900	Socket	253.00
SK620A	Socket	50.50	SK906	Chimney	44.00

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CHIP CAPACITORS

.8pf	10pf	100pf*	430pf
1pf	12pf	110pf	470pf
1.1pf	15pf	120pf	510pf
1.4pf	18pf	130pf	560pf
1.5pf	20pf	150pf	620pf
1.8pf	22pf	160pf	680pf
2.2pf	24pf	180pf	820pf
2.7pf	27pf	200pf	1000pf/.001uf*
3.3pf	33pf	220pf*	1800pf/.0018uf
3.6pf	39pf	240pf	2700pf/.0027uf
3.9pf	47pf	270pf	10,000pf/.01uf
4.7pf	51pf	300pf	12,000pf/.012uf
5.6pf	56pf	330pf	15,000pf/.015uf
6.8pf	68pf	360pf	18,000pf/.018uf
8.2pf	82pf	390pf	

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WATKINS JOHNSON WJ-V907: Voltage Controlled Microwave Oscillator $110.00

Frequency range 3.6 to 4.2GHz, Power ouput, Min. 10dBm typical, 8dBm Guaranteed. Spurious output suppression Harmonic (nf_0), min. 20dB typical, In-Band Non-Harmonic, min. 60dB typical, Residual FM, pk to pk, Max. 5KHz, pushing factor, Max. 8KHz/V, Pulling figure (1.5:1 VSWR), Max. 60MHz, Tuning voltage range +1 to +15volts, Tuning current, Max. -0.1mA, modulation sensitivity range, Max. 120 to 30MHz/V, Input capacitance, Max. 100pf, Oscillator Bias +15 +-0.05 volts @ 55mA, Max.

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MHz electronics

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4CX10000D/8171	500.00
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TEKTRONIX	
MODEL RM565 Dual Beam Oscilloscope 10 MHz with a 3A6 Dual Trace and a 3A72 Dual Trace.	$1107.50
MODEL 549 Storage Oscilloscope Bench 50 MHz with a CA Dual Trace.	$1000.00
MODEL 647A Oscilloscope Bench 100 MHz with a 10A2 Dual Trace and a 11B2A Time Base.	$1200.00

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DEFECTIVE MATERIAL: All claims for defective material must be made within sixty (60) days after receipt of parcel. All claims must include the defective material (for testing purposes), our invoice number, and the date of purchase. All returns must be packed properly or it will void all warranties.

DELIVERY: Orders are normally shipped within 48 hours after receipt of customer's order. If a part has to be backordered the customer is notified. Our normal shipping method is via First Class Mail or UPS depending on size and weight of the package. On test equipment it is by Air only, FOB shipping point.

FOREIGN ORDERS: All foreign orders must be prepaid with cashier's check or money order made out in U.S. Funds. We are sorry but C.O.D. is not available to foreign countries and Letters of Credit are not an acceptable form of payment either. Further information is available on request.

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INSURANCE: Please include 25¢ for each additional $100.00 over $100.00, United Parcel only.

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11C90DC	650MC Prescaler divide by 10/11	15.50
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VARIAN GALLIUM ARSENIDE GUNN DIODES MODEL VSX-9201S5
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VARI-L Co. Inc. MODEL SS-43 AM MODULATOR
Freq. Range 60 10 150MC, Insertion Loss 13dB Nominal, Signal Port Imp. 50ohms Nominal, Signal Port RF Power +10dBm Max., Modulation Port BW DC to 1KHZ, Modulation Port Bias 1ma. Nominal. **$24.99**

AVANTEK CASCADABLE MODULAR AMPLIFIERS	Model UTO-504	UTO-511
Frequency Range	5 to 500 MHz	5 to 500 MHz
Gain	6dB	15dB
Noise Figure	11dB	2.3dB to 3dB
Power Output	+17dB	−2dB to −3dB
Gain Flatness	1dB	1dB
Input Power Vdc	+24	+15
mA	100	10
PRICE	$70.00	$75.00

HEWLETT PACKARD MIXERS MODELS	10514A	10514B
Frequency Range	2MHz to 500MC	2MHz to 500MC
Input/Output Frequency L & R	200KHz to 500MC	200KHz to 500MC
X	DC to 500MC	DC to 500MC
Mixer Conversion Loss (A)	7dB	7dB
(B)	9dB	9dB
Noise Performance (SSB) (A)	7dB	7dB
(B)	9dB	9dB
PRICE	$49.99	$39.99

FREQUENCY SOURCES, INC MODEL MS-74X MICROWAVE SIGNAL SOURCE
MS-74X: Mechanically Tunable Frequency Range (MHz) 10630 to 11230 (10.63 to 11.23GHz) Minimum Output Power (mW) 10, Overall Multiplier Ratio 108, Internal Crystal Oscillator Frequency Range (MHz) 98.4 to 104.0, Maximum Input Current (mA) 400.

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HEWLETT PACKARD 1N5712 MICROWAVE DIODE
This diode will replace the MBD101, 1N5711, 5082-2800, 5082-2835 ect. This will work like a champ in all those Down Converter projects. **$1.50 or 10/$10.00**

MOTOROLA MHW1172R LOW DISTORTION WIDEBAND AMPLIFIER MODULE.
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A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super instructions. This is the finest unit available.

FM-3 Kit **$14.95**
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Led Blinky Kit

A great attention getter which alternately flashes 2 jumbo LEDs. Use for name badges, buttons, warning panel lights, anything! Runs on 3 to 15 volts. Complete kit, BL-1 **$2.95**

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A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2 W rms output, runs on 6 to 15 volts, uses 8-45 ohm speaker. Complete kit, BN-9 **$5.95**

CPO-1

Runs on 3-12 Vdc 1 watt out, 1 KHZ good for CPO, Alarm, Audio Oscillator. Complete kit **$2.95**

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Transmits up to 300' to any FM broadcast radio, uses any type of mike. Runs on 3 to 9V. Type FM-2 has added sensitive mike preamp stage.

FM-1 kit **$3.95** FM-2 kit **$4.95**

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An interesting kit, small mike picks up sounds and converts them to light. The louder the sound, the brighter the light. Includes mike, controls up to 300 W, runs on 110 VAC. Complete kit, WL-1 **$6.95**

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A complete tone decoder on a single PC board. Features: 400-5000 Hz adjustable range via 20 turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts. Complete kit, TD-1 **$5.95**

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MB-1 Kit **$4.95**

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Runs on 5-15 VDC. Low current (2.5ma). 1 min/month accuracy. TB-7 Kit **$5.50**
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For wired and tested clocks add $10.00 to kit price.
SPECIFY 12 OR 24 HOUR FORMAT

Car Clock

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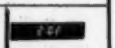

Here's a super looking, rugged and accurate auto clock, which is a snap to build and install. Clock movement is completely assembled — you only solder 3 wires and 2 switches, takes about 15 minutes! Display is bright green with automatic brightness control photocell — assures you of a highly readable display, day or night. Comes in a satin finish anodized aluminum case which can be attached 5 different ways using 2 sided tape. Choice of silver, black or gold case (specify).

DC-3 kit, 12 hour format **$22.95**
DC-3 wired and tested **$29.95**

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DC-9 **$34.95**

Under Dash Car Clock

12/24 hour clock in a beautiful plastic case features 6 jumbo RED LEDS, high accuracy (.001%), easy 3 wire hookup, display blanks with ignition, and super instructions. Optional dimmer automatically adjusts display to ambient light level.

DC-11 clock with mtg. bracket **$27.95 kit**
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FND 359 .4" C.C.	$1.00
FND 507/510 .5" C.A.	1.00
MAN 72/HP7730 .33" C.A.	1.00
HP 7681 .43" C.A.	2.00

Sockets

8 Pin	10/$2.00
14 Pin	10/$2.00
16 Pin	10/$2.00
24 Pin	4/$2.00
28 Pin	4/$2.00
40 Pin	3/$2.00

TRANSISTORS

2N3904 NPN C+F	15/$1.00
2N3906 PNP C+F	15/$1.00
2N4403 PNP C+F	15/$1.00
2N4410 NPN C+F	15/$1.00
2N4916 FET C+F	4/$1.00
2N5401 PNP C+F	5/$1.00
2N6028 C+F	4/$1.00
2N3771 NPN Silicon	$1.00
2N5179 UHF NPN	3/$2.00
Power Tab NPN 40W	3/$1.00
Power Tab PNP 40W	3/1.00
MPF 102/2N5484	$.50
NPN 3904 Type T+R	50/$2.50
PNP 3906 Type T+R	50/$2.50
2N3055	$.60
2N2646 UJT	3/$2.00

Diodes

5.1 V Zener	20/$1.00
1N914 Type	50/$1.00
1KV 2Amp	8/$1.00
100V 1Amp	15/$1.00

25 AMP 100V Bridge **$1.50 each**

Mini-Bridge 50V 1 AMP 2 for $1.00

Resistor Ass't

Assortment of Popular values - ¼ watt. Cut lead for PC mounting, ½" center, ½" leads, bag of 300 or more. **$1.50**

Switches

Mini toggle SPDT **$1.00**
Red Pushbuttons N.O. **3/$1.00**

Earphones

3" leads, 8 ohm, good for small tone speakers, alarm clocks, etc. 5 for $1.00

Mini 8 ohm Speaker

Approx. 2¼" diam. Round type for radios, mike etc. **3 for $2.00**

Solid State Buzzers

small buzzer 450 Hz, 85 dB, sound output on 5-12 vdc at 10-30 mA, TTL compatible **$1.50**

Slug Tuned Coils

Small 3/16" Hex Slugs turned coil 3 turns. 10 for $1.00

AC Outlet

Panel Mount with Leads **4/$1.00**

CAPACITORS

TANTALUM Dipped Epoxy	ALUMINUM Electrolytic	DISK CERAMIC
1.5 uF 25V 3/$1.00	1000 uF 16V Radial $.50	01 16V disk 20/$1.00
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DC-DC Converter

+5 vdc input prod. -9 vdc @ 30ma
+9 vdc produces -15 vdc @ 35ma **$1.25**

Ceramic IF Filters

Mini ceramic filters 7 kHz B.W. 455 kHz $1.50 ea.

25K 20 Turn Trim Pot **$1.00**
1K 20 Turn Trim Pot **$ .50**

Trimmer Caps

Sprague - 3-40 pf Stable Polypropylene .50 ea.

Crystal Microphone

Small 1" diameter ¼" thick crystal mike cartridge **$.75**

Mini RG-174 Coax

10 ft. for $1.00

Coax Connector

Chassis mount BNC type **$1.00**

9 Volt Battery Clips

Nice quality clips **5 for $1.00**
¼" Rubber Grommets **10 for $1.00**

Parts Bag

Asst. of chokes, disc. caps, tant. resistors, transistors, diodes MICA caps etc. sm. bag (100 pc) **$1.00** lg. bag (300 pc) **$2.50**

Connectors

6 pin type gold contacts for mA-1003 car clock module price **.75 ea.**

Leds

- your choice, please specify
Mini Red, Jumbo Red, High Intensity Red, Illuminator Red **8/$1**
Mini Yellow, Jumbo Yellow, Jumbo Green **6/$1**

Varactors

Motorola MV 2209 30 PF Nominal cap 20-80 PF - Tunable range - **.50 each or 3/$1.00**

Crystals

3.579545	MHZ	$1.50
10.00000	MHZ	$5.00
5.248800	MHZ	$5.00

AC Adapters

Good for clocks, nicad chargers, all 110 VAC plug one end

8.5 vdc @ 20 mA	$1.00
16 vac @ 160mA	$2.50
12 vac @ 250mA	$3.00

Audio Prescaler

Make high resolution audio measurements, great for musical instrument tuning, PL tones, etc. Multiplies audio UP in frequency, selectable x10 or x100, gives .01 HZ resolution with 1 sec. gate time! High sensitivity of 25 mv, 1 meg input z and built-in filtering gives great performance. Runs on 9V battery, all CMOS.

PS-2 kit **$29.95**
PS-2 wired **$39.95**

600 MHz PRESCALER

Extend the range of your counter to 600 MHz. Works with all counters. Less than 150 mv sensitivity. specify - 10 or -100

Wired, tested, PS-1B **$59.95**
Kit, PS-1B **$44.95**

30 Watt 2 mtr PWR AMP

Simple Class C power amp features 8 times power gain. 1 W in for 8 out, 2 W in for 15 out, 4W in for 30 out. Max output of 35 W, incredible value, complete with all parts, less case and T-R relay.

PA-1, 30 W pwr amp kit **$22.95**
TR-1, RF sensed T-R relay kit **6.95**

MRF-238 transistor as used in PA-1 8-10db gain 150 mhz **$11.95**

RF actuated relay senses RF (1W) and closes DPDT relay. For RF sensed T-R relay TR-1 Kit **$6.95**

Power Supply Kit

Complete triple regulated power supply provides variable 6 to 18 volts at 200 ma and +5 at 1 Amp. Excellent load regulation, good filtering and small size. Less transformers, requires 6.3 V ct 1 A and 24 VCT.

Complete kit, PS-3LT **$6.95**

OP-AMP Special

BI-FET LF 13741 - Direct pin for pin 741 compatible, but 500,000 MEG input z, super low 50 pa input current, low power drain.

50 for only $9.00 **10 for $2.00**

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78MG	$1.25	7812	$1.00
79MG	$1.25	7815	$1.00
723	$.50	7905	$1.25
309K	$1.15	7912	$1.25
7805	$1.50	7915	$1.25

Shrink Tubing Nubs

Nice precut pces of shrink size: 1" x ¼" shrink to ¼". Great for splices. **50/$1.00**

Mini TO-92 Heat Sinks

Thermalloy Brand **5 for $1.00**
TO-220 Heat Sinks **3 for $1.00**

Opto Isolators - 4N28 type **$.50 ea.**
Opto Reflectors - Photo diode + LED **$1.00 ea.**

Molex Pins

Molex already precut in length of 7. Perfect for 14 pin sockets. **20 strips for $1.00**

CDS Photocells

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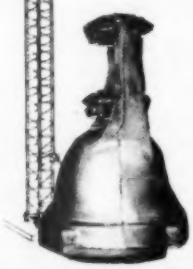

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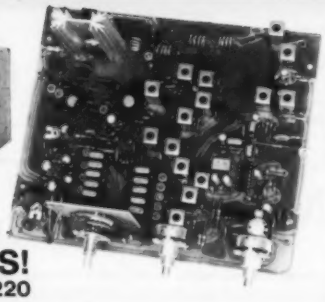

FM-5 PC Board Kit – **ONLY $159.95**
complete with controls, heatsink, etc.

SPECIAL OFFER Free cabinet kit, complete with speaker, knobs, connectors, hardware. A $59.95 value, yours free with purchase of kit. Hurry! Offer limited.

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10 watts, 5 Channels, for 6M, 2M, or 220

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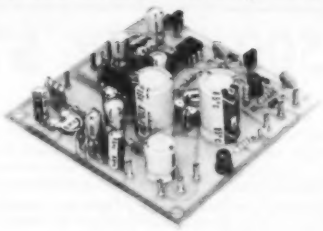

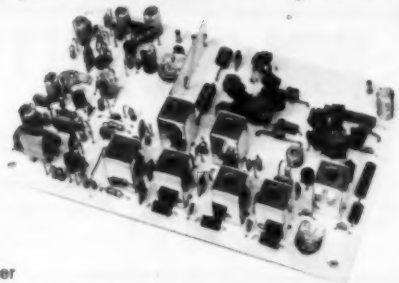

- **R76 VHF FM RECEIVER** for 10M, 6M, 2M, 220, or commercial bands. Fantastic selectivity options. Kits from $84.95 to $109.95
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- **COR KITS** With audio mixer and speaker amplifier. Only $29.95.
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- **A16 RF TIGHT BOX** Deep drawn alum. case with tight cover and no seams. 7 x 8 x 2 inches. Only $18.00.
- **SCANNER CONVERTERS** Copy 72-76, 135-144, 240-270, 400-420, or 806-894 MHz bands on any scanner. Wired/tested Only $79.95.
- **T51 VHF FM EXCITER** for 10M, 6M, 2M, 220 MHz or adjacent bands. 2 Watts continuous. Kits only $54.95.
- **T451 UHF FM EXCITER** 2 to 3 Watts on 450 ham band or adjacent. Kits only $64.95.
- **VHF & UHF LINEAR AMPLIFIERS.** Use on either FM or SSB. Power levels from 10 to 45 Watts to go with exciters & xmtg converters. Kits from $69.95.

VHF & UHF TRANSMITTING CONVERTERS

For SSB, CW, ATV, FM, etc. Available for 6M, 2M, 220, 440 with many IF input ranges. Converter board kit only at $79.95 (VHF) or $99.95 (UHF) or kits complete with PA and cabinet as shown.

VHF & UHF RECEIVING CONVERTERS

20 Models cover every practical rf and if range to listen to SSB, FM, ATV, etc. on 6M, 2M, 220, 440, and 110 aircraft band. Even convert weather down to 2M! Kits from $39.95 and wired units.

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VHF Kits from 27 to 300 MHz. UHF Kits from 300 to 650 MHz. Broadband Kits: 20-650 MHz. Prices start at $14.95 (VHF) and $18.95 (UHF). All preamps and converters have noise figure 2dB or less.

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9 DIGITS 600 MHz $129.95 WIRED

The CT-90 is the most versatile, feature packed counter available for less than $300.00! Advanced design features include; three selectable gate times, nine digits, gate indicator and a unique display hold function which holds the displayed count after the input signal is removed! Also, a 10mHz TCXO time base is used which enables easy zero beat calibration checks against WWV. Optionally; an internal nicad battery pack, external time base input and Micro-power high stability crystal oven time base are available. The CT-90, performance you can count on!

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 10 MV to 150 MHz Less than 50 MV to 500 MHz
Resolution:	0.1 Hz (10 MHz range) 1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	9 digits 0.4" LED
Time base:	Standard-10.000 mHz, 1.0 ppm 20-40°C. Optional Micro-power oven-0.1 ppm 20-40°C
Power:	8-15 VAC @ 250 ma

PRICES:

CT-90 wired, 1 year warranty	$129.95
CT-90 Kit, 90 day parts warranty	109.95
AC-1 AC adapter	3.95
BP-1 Nicad pack +AC Adapter/Charger	12.95
OV-1, Micro-power Oven time base	49.95
External time base input	14.95

7 DIGITS 525 MHz $99.95 WIRED

SPECIFICATIONS:

Range:	20 Hz to 525 MHz
Sensitivity:	Less than 50 MV to 150 MHz Less than 150 MV to 500 MHz
Resolution:	1.0 Hz (5 MHz range) 10.0 Hz (50 MHz range) 100.0 Hz (500 MHz range)
Display:	7 digits 0.4" LED
Time base:	1.0 ppm TCXO 20-40°C
Power:	12 VAC @ 250 ma

The CT-70 breaks the price barrier on lab quality frequency counters. Deluxe features such as; three frequency ranges - each with pre-amplification, dual selectable gate times, and gate activity indication make measurements a snap. The wide frequency range enables you to accurately measure signals from audio thru UHF with 1.0 ppm accuracy - that's .0001%! The CT-70 is the answer to all your measurement needs, in the field, lab or ham shack.

PRICES:

CT-70 wired, 1 year warranty	$99.95
CT-70 Kit, 90 day parts warranty	84.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC adapter/charger	12.95

7 DIGITS 500 MHz $79.95 WIRED

PRICES:

MINI-100 wired, 1 year warranty	$79.95
AC-Z Ac adapter for MINI-100	3.95
BP-Z Nicad pack and AC adapter/charger	12.95

Here's a handy, general purpose counter that provides most counter functions at an unbelievable price. The MINI-100 doesn't have the full frequency range or input impedance qualities found in higher price units, but for basic RF signal measurements, it can't be beat! Accurate measurements can be made from 1 MHz all the way up to 500 MHz with excellent sensitivity throughout the range, and the two gate times let you select the resolution desired. Add the nicad pack option and the MINI-100 makes an ideal addition to your tool box for "in-the-field" frequency checks and repairs.

SPECIFICATIONS:

Range:	1 MHz to 500 MHz
Sensitivity:	Less than 25 MV
Resolution:	100 Hz (slow gate) 1.0 KHz (fast gate)
Display:	7 digits, 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	5 VDC @ 200 ma

8 DIGITS 600 MHz $159.95 WIRED

NEW READ RECEIVER FREQUENCY

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 25 mv to 150 MHz Less than 150 mv to 600 MHz
Resolution:	1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	8 digits 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	110 VAC or 12 VDC

The CT-50 is a versatile lab bench counter that will measure up to 600 MHz with 8 digit precision. And, one of its best features is the Receive Frequency Adapter, which turns the CT-50 into a digital readout for any receiver. The adapter is easily programmed for any receiver and is simple connection to the receiver's VFO is all that is required for use. Adding the receiver adapter in no way limits the operation of the CT-50, the adapter can be conveniently switched on or off. The CT-50, a counter that can work double-duty!

PRICES:

CT-50 wired, 1 year warranty	$159.95
CT-50 Kit, 90 day parts warranty	119.95
RA-1, receiver adapter kit	14.95
RA-1 wired and pre-programmed (send copy of receiver schematic)	29.95

DIGITAL MULTIMETER $99.95 WIRED

PRICES:

DM-700 wired, 1 year warranty	$99.95
DM-700 Kit, 90 day parts warranty	79.95
AC-1, AC adaptor	3.95
BP-3, Nicad pack +AC adapter/charger	19.95
MP-1, Probe kit	2.95

The DM-700 offers professional quality performance at a hobbyist price. Features include; 26 different ranges and 5 functions, all arranged in a convenient, easy to use format. Measurements are displayed on a large 3½ digit, ½ inch LED readout with automatic decimal placement, automatic polarity, overrange indication and overload protection up to 1250 volts on all ranges, making it virtually goof-proof! The DM-700 looks great, a handsome, jet black, rugged ABS case with convenient retractable tilt bail makes it an ideal addition to any shop.

SPECIFICATIONS:

DC/AC volts:	100uV to 1 KV, 5 ranges
DC/AC current:	0.1uA to 2.0 Amps, 5 ranges
Resistance:	0.1 ohms to 20 Megohms, 6 ranges
Input impedance:	10 Megohms, DC/AC volts
Accuracy:	0.1% basic DC volts
Power:	4 'C' cells

AUDIO SCALER

For high resolution audio measurements, multiplies UP in frequency.

- Great for PL tones
- Multiplies by 10 or 100
- 0.01 Hz resolution!

$29.95 Kit $39.95 Wired

ACCESSORIES

Telescopic whip antenna - BNC plug	$ 7.95
High impedance probe, light loading	15.95
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Direct probe, general purpose usage	12.95
Tilt bail, for CT 70, 90, MINI-100	3.95
Color burst calibration unit, calibrates counter against color TV signal	14.95

COUNTER PREAMP

For measuring extremely weak signals from 10 to 1,000 MHz. Small size, powered by plug transformer-included.

- Flat 25 db gain
- BNC Connectors
- Great for sniffing RF with pick-up loop

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(Sensational New Hold Device For Your Phone)

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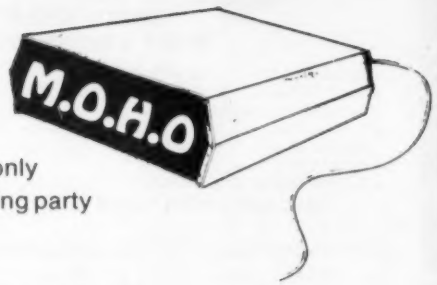

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- Unique 4 minute cutoff if calling party is forgotten.
- Can be used to provide music for the calling party.
- FCC Approved.

MOHO is accessible from any phone in your home.

$37.50 Assembled & Tested

Kit $29.95 Complete

(For rotary dial add $1.50 per phone)

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Isolated independent outputs
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25 Volt line adjustable with 10 turn pot from 23.5 V to 28 Volts. 120 Volt - 60 Hz input Fused - H=3¾" W=5½" D=4"

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MC6871A

7.50 w/data **3/20.00**

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- ★ **Control up to 1 amp**

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Kit includes all parts necessary to build this exciting kit. Uses: Children's T.V. programs - Darkroom exposures - Amateur 10 min. I.D.er - Egg Timer - Intermittent Windshield Wiper. Absolutely endless uses. Complete kit including power supply, p.c. board DPDT relay, and all parts to make timer operational.

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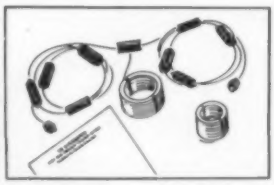

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Only$59.95

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MODEL PLF-2... Improves weak signals as much as image and spurious rejection of most receivers. Direct switching to rec. or preamp. Includes pwr. supp. 117 VAC wired & tested..... **$52.95**
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MODEL PT-2... For transceiver use. Continuously tunable from 6 to 160 meters. Features dual-gate FET transistor amplifier for improved receiver sensitivity and low noise figure. Requires no transceiver modifications and can handle up to 250W transceiver output, 117 VAC 60 Hz.... **$79.95**
MODEL PT-2E...240 VAC 50-60 Hz operation **$84.95**

TRANSCOM

PROGRAMMABLE SUB AUDIBLE TONE ENCODER FOR ICOM HANDHELDS.

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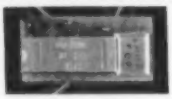

$29.95 Plus $2.00 shipping and handling

- ONLY 1.1" X 55" X .2"
- PRESET OUTPUT LEVEL FOR IC2A
- LOW TONE DISTORTION LESS THAN 1% THD
- TONE STABILITY ± .2% Hz FROM -20C TO +70C
- 1 YEAR LIMITED FACTORY WARRANTY
- 5VDC POWERED

ICOM

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- VERSATILE
- AFFORDABLE
- WIDE RANGE OF ACCESSORIES AVAILABLE

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- SCANNING

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7400

SN7400N	.20	SN7472N	.29	SN74156N	.79
SN7401N	.20	SN7473N	.35	SN74157N	.69
SN7402N	.25	SN7474N	.35	SN74160N	.89
SN7403N	.25	SN7475N	.49	SN74161N	.89
SN7404N	.25	SN7476N	.35	SN74162N	.89
SN7405N	.29	SN7479N	5.00	SN74163N	.89
SN7406N	.39	SN7480N	.59	SN74164N	.89
SN7407N	.39	SN7482N	.99	SN74166N	.89
SN7408N	.29	SN7483N	.89	SN74166N	1.25
SN7409N	.29	SN7485N	.89	SN74167N	2.79
SN7410N	.25	SN7486N	.35	SN74170N	1.95
SN7411N	.29	SN7489N	1.75	SN74172N	4.95
SN7412N	.35	SN7490N	.49	SN74173N	1.39
SN7413N	.40	SN7491N	.59	SN74174N	.99
SN7414N	.69	SN7492N	.45	SN74175N	.89
SN7416N	.29	SN7493N	.45	SN74176N	.79
SN7417N	.29	SN7494N	.69	SN74177N	.79
SN7420N	.25	SN7495N	.69	SN74179N	1.49
SN7421N	.29	SN7496N	.69	SN74180N	.79
SN7422N	.45	SN7497N	3.00	SN74181N	2.25
SN7423N	.29	SN74100N	1.49	SN74182N	.79
SN7425N	.29	SN74104N	.39	SN74184N	2.49
SN7426N	.29	SN74105N	.89	SN74185N	2.49
SN7427N	.25	SN74107N	.35	SN74190N	1.25
SN7428N	.49	SN74108N	.39	SN74191N	1.25
SN7430N	.25	SN74116N	1.95	SN74192N	.89
SN7432N	.29	SN74121N	.39	SN74193N	.89
SN7437N	.29	SN74122N	.55	SN74194N	.89
SN7438N	.40	SN74123N	.59	SN74195N	.69
SN7439N	.25	SN74125N	.49	SN74196N	.89
SN7440N	.20	SN74126N	.49	SN74197N	.89
SN7441N	.69	SN74132N	.75	SN74198N	1.49
SN7442N	.59	SN74136N	.75	SN74199N	1.49
SN7443N	1.10	SN74141N	.99	SN74221N	1.25
SN7444N	1.10	SN74142N	3.25	SN74251N	.99
SN7445N	.89	SN74143N	3.49	SN74276N	1.49
SN7446N	.79	SN74144N	3.49	SN74279N	.79
SN7447N	.69	SN74145N	.79	SN74283N	1.49
SN7448N	.79	SN74147N	1.95	SN74284N	3.95
SN7450N	.20	SN74148N	1.29	SN74285N	3.95
SN7451N	.20	SN74150N	1.25	SN74365N	.69
SN7453N	.20	SN74151N	.69	SN74366N	.69
SN7454N	.20	SN74152N	.69	SN74367N	.69
SN7459A	.25	SN74153N	.79	SN74368N	.69
SN7460N	.20	SN74154N	1.25	SN74390N	1.49
SN7470N	.29	SN74155N	.79	SN74393N	1.49

74LS00

74LS00	.29	74LS82	.75	74LS192	1.15
74LS01	.29	74LS83	.75	74LS193	1.15
74LS02	.29	74LS85	.99	74LS196	1.15
74LS03	.29	74LS86	1.15	74LS197	1.19
74LS04	.35	74LS107	.45	74LS221	1.19
74LS05	.35	74LS109	.45	74LS240	1.49
74LS08	.35	74LS112	.45	74LS241	1.49
74LS09	.35	74LS113	.49	74LS242	1.49
74LS10	.35	74LS114	.49	74LS244	1.49
74LS11	.39	74LS122	.55	74LS245	2.95
74LS12	.35	74LS123	1.25	74LS247	1.19
74LS13	.69	74LS124	3.95	74LS248	1.19
74LS14	.99	74LS125	.59	74LS249	1.19
74LS15	.35	74LS126	.59	74LS251	.99
74LS20	.35	74LS132	.99	74LS253	.99
74LS21	.35	74LS133	.89	74LS257	.89
74LS22	.35	74LS136	.49	74LS258	.89
74LS26	.35	74LS138	.89	74LS260	.69
74LS27	.35	74LS139	.89	74LS266	.69
74LS30	.35	74LS151	.89	74LS273	1.95
74LS32	.35	74LS153	.89	74LS279	.89
74LS33	.69	74LS154	1.75	74LS283	.89
74LS37	.45	74LS155	.89	74LS290	.99
74LS38	.39	74LS156	.89	74LS293	.99
74LS40	.35	74LS157	.89	74LS298	.99
74LS42	.89	74LS158	.89	74LS298	1.25
74LS47	.89	74LS160	1.15	74LS352	1.29
74LS48	1.15	74LS161	1.15	74LS353	1.29
74LS49	1.15	74LS162	1.15	74LS365	.69
74LS51	.35	74LS163	1.15	74LS366	.69
74LS54	.35	74LS164	1.15	74LS367	.69
74LS55	.35	74LS165	1.15	74LS368	.69
74LS73	.45	74LS168	1.19	74LS373	1.95
74LS74	.45	74LS169	1.19	74LS374	1.95
74LS75	.69	74LS170	1.95	74LS375	.89
74LS76	.45	74LS173	.99	74LS377	.89
74LS78	.49	74LS174	.99	74LS393	2.49
74LS83	.99	74LS175	.99	74LS399	2.49
74LS86	1.25	74LS181	2.95	74LS490	2.49
74LS86	.49	74LS190	1.25	81LS95	1.95
74LS90	.69	74LS191	1.25	81LS97	1.95

74S00

74S00	.45	74S124	3.95	74S243	3.25
74S02	.45	74S132	.65	74S244	3.25
74S03	.45	74S133	.65	74S251	1.45
74S04	.55	74S134	.69	74S257	1.35
74S05	.55	74S135	1.19	74S258	1.35
74S08	.50	74S136	1.75	74S260	.79
74S09	.50	74S138	1.35	74S280	2.95
74S10	.45	74S139	1.35	74S287	3.25
74S11	.45	74S140	.79	74S288	2.75
74S15	.45	74S151	1.35	74S373	3.49
74S20	.45	74S153	1.35	74S374	3.49
74S22	.45	74S157	1.35	74S387	2.95
74S30	.45	74S158	1.35	74S471	10.95
74S38	.55	74S160	2.95	74S472	10.95
74S40	1.25	74S174	1.59	74S473	10.95
74S51	.50	74S175	1.59	74S474	12.95
74S64	.45	74S188	2.95	74S475	12.95
74S65	.50	74S194	1.95	74S570	5.95
74S74	.50	74S195	1.95	74S571	5.95
74S86	.75	74S196	1.95	74S572	5.95
74S112	.79	74S240	2.95	74S573	9.95
74S113	.79	74S241	2.95	74S940	3.15
74S134	.79	74S242	3.25	74S941	3.15

CA–LINEAR

CA3010H	.99	CA3060N	3.25	CA3089N	3.75
CA3013H	2.15	CA3080H	1.25	CA3086N	3.95
CA3023H	3.25	CA3080H	1.25	CA3130H	1.79
CA3035H	2.69	CA3080N	1.25	CA3140H	1.25
CA3039H	1.35	CA3082N	2.00	CA3160H	1.25
CA3046N	1.30	CA3083N	1.60	CA3401N	.59
CA3059N	3.25	CA3086N	.85	CA3600N	3.50

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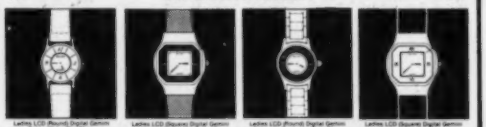
CD4000	.39	CD4041	1.49	CD 4098	2.49
CD4001	.39	CD4042	.99	CD4500	.79
CD4002	.39	CD4043	.89	CD4507	.99
CD4006	1.19	CD4044	.89	CD4508	3.95
CD4007	.25	CD4046	1.79	CD4510	1.39
CD4009	.49	CD4047	2.50	CD4511	1.29
CD4010	.49	CD4048	1.35	CD4512	1.49
CD4011	.39	CD4049	.49	CD4514	3.95
CD4012	.25	CD4050	.59	CD4515	2.95
CD4013	.49	CD4051	1.19	CD4516	1.49
CD4014	1.39	CD4052	1.19	CD4518	1.79
CD4015	1.19	CD4053	1.19	CD4519	.89
CD4016	.59	CD4055	2.95	CD4520	1.29
CD4017	1.19	CD4056	2.95	CD4522	1.79
CD4018	.59	CD4059	9.95	CD4543	2.79
CD4019	.49	CD4060	1.49	CD4552	11.95
CD4020	1.19	CD4066	.79	CD4566	2.79
CD4021	1.39	CD4068	.39	CD4583	2.49
CD4022	1.19	CD4069	.45	CD4584	.75
CD4023	.29	CD4070	.59	CD4723	1.95
CD4024	.79	CD4071	.49	CD4724	1.95
CD4025	.23	CD4072	.49	MC14409	17.95
CD4026	2.95	CD4073	.39	MC14410	18.95
CD4027	.49	CD4075	.39	MC14411	15.95
CD4028	.89	CD4076	1.39	MC14412	15.95
CD4029	1.49	CD4078	.55	MC14419	7.95
CD4030	.49	CD4081	.39	MC14433	15.95
CD4034	3.49	CD4082	.59	MC14538	2.49
CD4035	.99	CD4083	.99	MC14541	1.95
CD4040	1.49				

Bulova Quartz Ladies Watches

ONE YEAR FACTORY WARRANTY



Ladies LCD (Round) Digital Gemini Sonic with Leather Strap
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LITRONIX Stick Display Sale

SALE!

MULTI-DIGIT REFLECTOR ARRAYS FOR CLOCKS

PART NUMBER	DIGIT SIZE (INCH)	POLARITY	DESCRIPTION / ELEMENT USED	OVERALL DIM. LENGTH x Height x Depth	LOGIC INPUT CURRENT TYP	LOGIC INPUT CURRENT MAX	MULTIPLEX OPTIONS (Duty Factor & Drive) TYP	MAX	INTERFACE CIRCUIT REQUIREMENTS (Logic Family)	PRICE	2 FOR SALE
DL-486 (Red)	.3	C.C. NPN	With Colon and Auxiliary Indicators	3.625"W x 0.47"H x 0.62"D	8	8	1/7	1/4	TTL	1.95	$175.00
DL-507 (Red)	.3			3.625"W x 0.47"H x 0.62"D	13	15				1.95	$175.00
DL-5407 (Red)	.3			3.625"W x 0.47"H x 0.62"D	8	8				4.95	$175.00
DL-4564 (Red)	.3	non-NPN		3.625"W x 0.47"H x 0.62"D	8	8				2.49	$175.00

MULTI-DIGIT REFLECTOR ARRAYS

DL-490 (Red)	.3	C.C. NPN	1 Req. 1 Digit Driver	0.687"W x 0.47"H x 0.62"D	13	15	1/7	1/5	1/7	70	$7.00
DLO-568 (Grn)	.3	C.A. NPN	1 Req. 1 Digit Driver	1.125"W x 0.47"H x 0.62"D	13	15	1/6	1/5	1/6	80	$15.00
DL-490 (Red)	.3	C.C. NPN	1 Req. 1 Digit Driver	1.125"W x 0.47"H x 0.62"D	13	15	1/6	1/5	1/6	80	$15.00
DL-493 (Red)	.3	C.A. NPN	1 Req. 1 Digit Driver	1.687"W x 0.47"H x 0.62"D	13	15	1/6	1/5	1/6	3.25	$17.00

NATIONAL Stick Display Sale

LED NUMERIC ARRAYS

SALE!

PART NO.	DIGIT SIZE (INCH)	FORMAT	DRIVE Comm. Cathode / Comm. Anode	OVERALL SIZE	PRICE
NSA100	.100 (2.5x3mm Stick)	8 8 8 8 8 8 8 8	C.C. 8 Digit Multiplexed	2"Lx.75"Hx.27"D	4.95
NSA105	.100 (2.5x3mm Stick)	8 8 8 8 8 8 8 8	C.C. 8 Digit Multiplexed	2"Lx.75"Hx.27"D	4.95
NSA200	.100 (2.5x3mm Stick)	8 8 8 8 8 8 8 8	3 Digit Multiplexed	2"Lx.75"Hx.27"D	4.95
NSA1105	.100 (2.5x3mm Stick)	88 88 88 C.C.	4 Digit Multiplexed	2"Lx.75"Hx.27"D	4.95
NSA1100	.100 (2.5x3mm Stick)	8 88 88 C.C.	5 Digit Multiplexed	2"Lx.75"Hx.27"D	4.95
NSA1200	.100 (2.5x3mm Stick)	8 8 8 8 8 8 8 8	C.C. 8 Digit Multiplexed	2.5"Lx.75"Hx.27"D	5.95

MULTI-DIGIT LED NUMERIC DISPLAYS

NSN373	.3 No Decimal	8 8	C.C.	2 Digit Direct	.85"Lx.60"Hx.200"D	2.75
NSN374	.3 No Decimal	8 8	C.A.	2 Digit Direct	.85"Lx.60"Hx.200"D	2.49
NSN381	.3 No Decimal	8 8	C.C.	2 Digit Direct	.85"Lx.60"Hx.200"D	2.49
NSN382	.3 No Decimal	8 8	C.A.	2 Digit Direct	.85"Lx.60"Hx.200"D	2.49
NSN383	.3 No Decimal	8 8	C.C.	2 Digit Multiplexed	1.45"Lx1.00"Hx.32"D (1.45"Lx.60"Hx.32"D w/ pins)	2.49
NSN384	.3 No Decimal	8 8	C.A.	2 Digit Multiplexed	1.45"Lx1.00"Hx.32"D (1.45"Lx.60"Hx.32"D w/ pins)	2.49
NSN385	.3	8 8	C.C.	2 Digit Direct	1.0"Lx1.00"Hx.20"D (1.0"Lx.60"Hx.20"D w/ pins)	2.49
NSN386	.3	8 8	C.A.	2 Digit Direct	1.0"Lx1.00"Hx.20"D (1.0"Lx.60"Hx.20"D w/ pins)	2.49
NSN387	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx1.00"Hx.20"D	1.75
NSN388	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx1.00"Hx.20"D	1.75
NSN1100	.2	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN1101	.2	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN1102	.2	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN1103	.2	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN2011	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN2012	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3011	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3012	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3021	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3022	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3031	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3032	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3041	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3042	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3051	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3052	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3061	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3062	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3071	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3072	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3081	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3082	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3091	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3092	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3101	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3102	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3111	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3112	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3121	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3122	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3131	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3132	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3141	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3142	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3151	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3152	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3161	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3162	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3171	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3172	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3181	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3182	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3191	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3192	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3201	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3202	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3211	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3212	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3221	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3222	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3231	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3232	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3241	.3	8 8	C.C.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75
NSN3242	.3	8 8	C.A.	2 Digit Multiplexed	1.0"Lx.80"Hx.20"D	1.75

*Standard Stocked Items - write for our specifications available on non-stocked items.

COMPUTER GRADE CAPACITORS

MFD	WVDC	PRICE	MFD	WVDC	PRICE	MFD	WVDC	PRICE
1.000	100	1.00	10,000	15	1.99	24,000	10	2.95
500	200	2.49	10,000	25	2.99	27,000	10	2.95
1,000	3	.99	10,000	50	3.99	27,000	15	3.95
1,000	25	1.99	11,000	50	5.49	33,000	10	3.95
1,000	50	2.99	12,000	50	6.49	36,000	10	4.95
2,000	15	1.99	15,000	15	2.99	36,000	15	5.95
2,000	25	2.99	15,000	25	3.99	36,000	25	7.95
2,000	50	3.99	15,000	50	7.95	40,000	10	4.95
2,500	15	2.49	18,000	10	3.95	50,000	10	5.95
2,500	25	3.49	20,000	10	3.95	50,000	15	7.95
3,000	15	2.99	20,000	15	4.95	72,000	10	7.95
3,000	25	4.49	22,000	7	3.95	100,000	10	9.95
4,000	15	3.95	22,000	10	4.95	200,000	10	12.95
5,000	50	9.95	23,000	20	9.95	200,000	3	12.95

OVER 200 OTHER VALUES AVAILABLE — CALL OR WRITE FOR YOUR REQUIREMENT

10 SALE!

LOW PROFILE (TIN) SOCKETS

	1-24	25-49	50-100
8 pin LP	.17	.16	.15
14 pin LP	.20	.19	.18
16 pin LP	.22	.21	.20
18 pin LP	.29	.28	.27
20 pin LP	.34	.32	.30
22 pin LP	.37	.36	.35
24 pin LP	.38	.37	.36
28 pin LP	.45	.44	.43
36 pin LP	.60	.59	.58
40 pin LP	.63	.62	.61

SOLDERTAIL STANDARD (TIN)

	1-24	25-49	50-100
14 pin ST	.27	.25	.24
16 pin ST	.30	.27	.26
18 pin ST	.35	.32	.30
24 pin ST	.49	.45	.42
28 pin ST	.99	.90	.81
36 pin ST	1.39	1.26	1.15
40 pin ST	1.59	1.45	1.30

SOLDERTAIL (GOLD) STANDARD

	1-24	25-49	50-100
8 pin SG	.39	.35	.31
14 pin SG	.49	.45	.41
16 pin SG	.54	.49	.44
18 pin SG	.59	.53	.48
24 pin SG	.79	.75	.69
28 pin SG	1.10	1.00	.90
36 pin SG	1.65	1.40	1.25
40 pin SG	1.75	1.59	1.45

WIRE WRAP SOCKETS (GOLD) LEVEL #3

	1-24	25-49	50-100
8 pin WW	.59	.54	.49
10 pin WW	.69	.63	.56
14 pin WW	.79	.73	.67
16 pin WW	.85	.77	.70
18 pin WW	.99	.90	.81
20 pin WW	1.19	1.08	.99
22 pin WW	1.49	1.35	1.23
24 pin WW	1.39	1.26	1.14
28 pin WW	1.69	1.53	1.38
36 pin WW	3.19	1.99	1.79
40 pin WW	3.29	2.09	1.89

1/4 WATT RESISTOR ASSORTMENTS – 5%

ASST. 1	5ea.	10 Ohm 12 Ohm 15 Ohm 18 Ohm 22 Ohm 27 Ohm 33 Ohm 39 Ohm 47 Ohm 56 Ohm	50pcs.	$1.95
ASST. 2	5ea.	68 Ohm 82 Ohm 100 Ohm 120 Ohm 150 Ohm 180 Ohm 220 Ohm 270 Ohm 330 Ohm 390 Ohm	50pcs.	$1.95
ASST. 3	5ea.	470 Ohm 560 Ohm 680 Ohm 820 Ohm 1K 1.2K 1.5K 1.8K 2.2K 2.7K	50pcs.	$1.95
ASST. 4	5ea.	3.3K 3.9K 4.7K 5.6K 6.8K 8.2K 10K 12K 15K 18K	50pcs.	$1.95
ASST. 5	5ea.	22K 27K 33K 39K 47K 56K 68K 82K 100K 120K	50pcs.	$1.95
ASST. 6	5ea.	150K 180K 220K 270K 330K 390K 470K 560K 680K 820K	50pcs.	$1.95
ASST. 7	5ea.	1M 1.2M 1.5M 1.8M 2.2M 2.7M 3.3M 3.9M 4.7M 5.6M	50pcs.	$1.95
ASST. 8R		Includes Resistor Assts. 1-7 (350 pcs.)		$10.95 ea.

$10.00 Minimum Order — U.S. Funds Only
California Residents Add 6% Sales Tax
Postage — Add 5% plus $1.50 Insurance
Send S.A.S.E. for Monthly Sale Flyer!

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Send 88¢ Postage for your *FREE* 1982 JAMECO CATALOG
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INTERSIL

Part No.	Function	Price
7045IPI	CMOS Precision Timer	14.95
7045EV/Kit*	Stopwatch Chip, XTL	29.95
7106CPL	3½ Digit A/D (LCD Drive)	16.95
7106EV/Kit*	IC, Circuit Board, Display	34.95
7107CPL	3½ Digit A/D (LED Drive)	16.95
7107EV/Kit*	IC, Circuit Board, Display	29.95
7116CPL	3½ Digit A/D LCD Dis. HLD.	18.95
7117CPL	3½ Digit A/D LED Dis. HLD.	17.95
7201IDR	Low Battery Volt Indicator	2.25
7208IPG	CMOS LED Stopwatch/Timer	12.95
7205EV/Kit*	Stopwatch Chip, XTL	19.95
7206CJPE	Tone Generator	5.25
7206EV/Kit*	Tone Generator Chip, XTL	12.95
7207AIPD	Oscillator Controller	6.50
7207AEV/Kit*	Freq. Counter Chip, XTL	13.95
7208IPI	Seven Decade Counter	17.95
7209IPA	Clock Generator	3.95
7215IPG	4 Func. CMOS Stopwatch CKT	13.95
7215EV/Kit*	4 Func. Stopwatch Chip, XTL	19.95
7216AIJI	8-Digit Univ. Counter C.A.	32.00
7216CIJI	8-Digit Freq. Counter C.A.	26.95
7216DIPI	8-Digit Freq. Counter C.C.	21.95
7217JI	4-Digit LED Up/Down Counter	12.95
7218CIJI	8-Digit Univ. LED Drive	10.95
7234IPL	LCD 4½ Digit Up Counter DRI	11.25
7235AIJL	8-Digit Univ. Counter	31.95
7236AEV/Kit*	5 Function Counter Chip, XTL	74.95
7240IJE	CMOS Bin Prog. Timer/Counter	4.95
7242IJA	CMOS Divide-by-256 RC Timer	2.95
7250IJE	CMOS BCD Prog. Timer/Counter	6.95
7260IJE	CMOS BCD Prog. Timer/Counter	5.25
7556IPA	CMOS 555 Timer (8 pin)	1.45
7556IPD	CMOS 556 Timer (14 pin)	2.20
7611BCPA	CMOS Op Amp Comparator	1MV 2.25
7612BCPA	CMOS Op Amp Ext. Cmvr.	1MV 2.95
7621BCPA	CMOS Dual Op Amp Comp.	1MV 3.95
7631CCPE	CMOS Tri Op Amp Comp.	1MV 5.25
7641CCPD	CMOS Quad Op Amp Comp.	1MV 7.50
7642CCPD	CMOS Quad Op Amp Comp.	1MV 7.50
7650CPA	Voltage Converter	2.95
8038CCPD	Waveform Generator	6.95
8048CCPE	Monolithic Logarithmic Amp	21.50
8069CCQ	50ppm Band-GAP Volt Ref. Diode	2.50
8211CPA	Volt Ref/Indicator	2.50
8212CPA	Volt Ref/Indicator	2.95

74C

74C00	.29	74C95	1.59	74C221	1.95
74C02	.39	74C107	1.89	74C240	2.25
74C04	.39	74C151	2.95	74C244	2.25
74C08	.39	74C154	3.95	74C373	2.49
74C10	.39	74C157	2.25	74C374	2.99
74C14	.79	74C161	1.95	74C901	.49
74C20	.39	74C163	1.95	74C903	.49
74C30	.39	74C164	1.

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PROPAGATION

J. H. Nelson
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Whiting NJ 08759

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	7A	14	14	14
ARGENTINA	21	21	14A	14	14	7A	14	21	21A	21A	21A	21A
AUSTRALIA	21	21	14	14	7B	7B	14B	14B	14B	14B	14	21
CANAL ZONE	21	14	14	14	14	7	14	14	21	21	21A	21A
ENGLAND	14	7	7	7	7	14	14	14	21	21	21	14
HAWAII	21	21	14	7	7	7	14	14	14	14	21	21
INDIA	14	14	7B	7B	7B	7B	14	14	14	14	14	14
JAPAN	21	14	14	7B	7B	7	7	7	7	14	14	14
MEXICO	21	14	14	14	7	7	14	14	14	21	21A	21A
PHILIPPINES	14	14	14	7B	7B	7B	7B	7B	14	14	14	14A
PUERTO RICO	21	14	14	14	7A	7A	14	14	21	21A	21A	21A
SOUTH AFRICA	14	14	7B	14	14	14	21	21	21A	21A	21A	14
U. S. S. R.	14	7	7	7	7	7A	14	14	21	14	14	14
WEST COAST	21	14	14	7	7	7	7A	14	14	14A	21	21

CENTRAL UNITED STATES TO:

ALASKA	14	14	14	7A	7	7	7	7	7A	14	14	14
ARGENTINA	21	21	14A	14	14	7A	7	14A	21A	21A	21A	21A
AUSTRALIA	21	21	14	14	14B	7B	14B	14B	14B	14B	14A	21
CANAL ZONE	21	14	14	14	14	7	14	21	21	21A	21A	21A
ENGLAND	14	7	7	7	7	7	14	14	14	14	14A	14
HAWAII	21	21	14	14	7A	7A	14	14	14	14	21	21
INDIA	14	14	14B	7B	7B	7B	7B	14	14	14	14	14
JAPAN	21	14	14	14B	7B	7	7	7	7	14	14	14
MEXICO	21	14	14	14	7	7	14	14	14	21	21A	21A
PHILIPPINES	14	14	14	14B	7B	7B	7B	7B	14	14	14	14A
PUERTO RICO	21	14	14	14	7A	7A	14	14	21	21A	21A	21A
SOUTH AFRICA	14	14	7B	7B	7B	7B	14	14	21	21	21	14
U. S. S. R.	14	7	7	7	7	7	14B	14	14	14	14	14

WESTERN UNITED STATES TO:

ALASKA	14	14	14	7A	7	7	7	7	7A	14	14	14
ARGENTINA	21	21	14A	14	14	7A	7	14	21	21	21A	21A
AUSTRALIA	21A	21A	21	14	14	14	14	14	14B	14B	21	21
CANAL ZONE	21	14A	14	14	14	7	14	14	14	21	21A	21A
ENGLAND	14	7	7	7	7	7	7B	14B	14	14	14	14
HAWAII	21A	21A	21	14A	14	14	14	14	14	21	21	21A
INDIA	14	14	14	14	7B	7B	7B	14B	14	14	14	14
JAPAN	21	21	14	14	14B	7	7	7	7	14	14	14A
MEXICO	21	21	14	14	7	7	7A	14	14	21	21A	21A
PHILIPPINES	21	14	14	14	14B	7B	7B	7B	14	14	14A	21
PUERTO RICO	21	14A	14	14	7A	7A	14	14	14	21	21A	21A
SOUTH AFRICA	14	14	7B	7B	7B	7B	14B	14	14	14	21	14
U. S. S. R.	14	7	7	7	7	7	7	14B	14	14	14	14
EAST COAST	21	14	14	7	7	7	7A	14	14	14A	21	21

First letter = day waves Second = night waves
A = Next higher frequency may also be useful
B = Difficult circuit this period F = Fair G = Good
P = Poor * = Chance of solar flares; # = of aurora

MAY

SUN	MON	TUE	WED	THU	FRI	SAT
						1 G/G
2 G/G	3 G/G	4 G/F	5 G/F	6 G/F	7 G/G	8 G/G
9 G/F	10 G/F	11 G/G	12 G/G	13 G/G	14 G/G	15 G/G
16 G/F*	17 F/F*	18 F/F*	19 F/F	20 F/F	21 G/F	22 G/G
23 G/G 30 G/G	24 F/P 31 G/G	25 F/P	26 G/G	27 G/G	28 G/G	29 G/F

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SALE SUBJECT FCC CERTIFICATION

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- Two VFOs for quick QSY across the band.
- Ten memory slots for storage and recall of favorite channels.
- Selectable synthesizer steps (5 kHz or 10 kHz) in dial or scanning mode.
- Priority channel for checking a favorite frequency for activity while monitoring another.
- Unique VFO/Memory Split mode for covering unusual repeater splits.
- Up/Down band scan plus memory scan for busy or clear channel. Scanning microphone included in purchase price.
- Full 25 watts of RF power output from extremely compact package.
- Built-in automatic or manual tone burst.
- Optional synthesized CTCSS Encode and Encode/Decode boards available.
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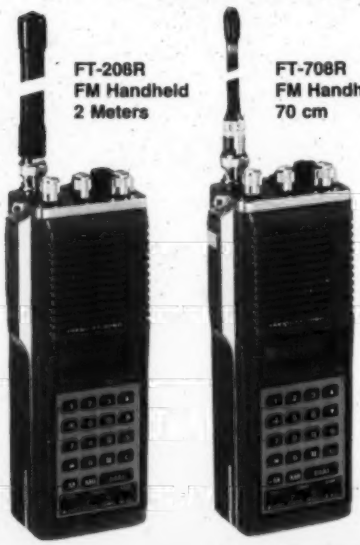
- Optional YM-49 Speaker/Microphone and YM-50 DTMF Encoding Microphone provide maximum operating versatility.



FT-208R
FM Handheld
2 Meters

FT-708R
FM Handheld
70 cm

And don't forget! Yaesu has a complete line of VHF and UHF handheld and battery portable transceivers using LCD display!!!

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Superior dynamic range, auto. antenna tuner, QSK, dual NB, 2 VFO's, general coverage receiver.

TS-930S

The TS-930S is a superlative, high performance, all-solid state, HF transceiver keyed to the exacting requirements of the DX and contest operator. It covers all Amateur bands from 160 through 10 meters, and incorporates a 150 kHz to 30 MHz general coverage receiver having an excellent dynamic range.

Among its other important features are, SSB slope tuning, CW VBT, IF notch filter, CW pitch control, dual digital VFO's, CW full break-in, automatic antenna tuner, and a higher voltage operated solid state final amplifier. It is available with or without the AT-930 automatic antenna tuner built-in.

TS-930S FEATURES:

- **160-10 Meters, with 150 kHz - 30 MHz general coverage receiver.**
  Covers all Amateur frequencies from 160-10 meters, including new WARC, 30, 17, and 12 meter bands, on SSB, CW, FSK, and AM. Features 150 kHz - 30 MHz general coverage receiver. Separate Amateur band access keys allow speedy band selection. UP/DOWN bandswitch changes in 1-MHz steps. A new, innovative, quadruple conversion, digital PLL synthesized circuit provides superior frequency accuracy and stability, plus greatly enhanced selectivity.
- **Excellent receiver dynamic range.**
  Receiver two-tone dynamic range, 100 dB typical (20 meters, 500 Hz CW bandwidth, at sensitivity of 0.25 μv, S/N 10 dB), provides the ultimate in rejection of IM distortion.
- **All solid state, 28 volt operated final amplifier.**
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- **Automatic antenna tuner, built-in.**
  Available with AT-930 antenna tuner built-in, or as an option. Covers Amateur bands 80-10 meters, including the new WARC bands. Tuning range automatically pre-selected with band selection to minimize tuning time. "AUTO-THRU" switch on front panel.
- **CW full break-in.**
  CW full break-in circuit uses CMOS logic IC plus reed relay for maximum flexibility, coupled with smooth, quiet operation. Switchable to semi-break-in.
- **Dual digital VFO's.**
  10-Hz step dual digital VFO's include band information. Each VFO tunes continuously from band to band. A large, heavy, flywheel type knob is used for improved tuning ease. T.F. Set switch allows fast transmit frequency setting for split-frequency operations. A=B switch for equalizing one VFO frequency to the other. VFO "Lock" switch provided. RIT control for ±9.9 kHz receive frequency shift.
- **Eight memory channels.**
  Stores both frequency and band information. VFO-MEMO switch allows use of each memory as an independent VFO, (the original memory frequency can be recalled at will), or as a fixed frequency. Internal Battery memory back-up, estimated 1 year life. (Batteries not Kenwood supplied).
- **Dual mode noise blanker ("pulse" or "woodpecker").**
  NB-1, with threshold control, for pulse-type noise. NB-2 for longer duration "woodpecker" type noise.
- **SSB IF slope tuning.**
  Allows independent adjustment of the low and/or high frequency slopes of the IF passband, for best interference rejection.
- **CW VBT and pitch controls.**
  CW VBT (Variable Bandwidth Tuning) control tunes out interfering signals. CW pitch controls shifts IF passband and simultaneously changes the pitch of the beat frequency. A "Narrow/Wide" filter selector switch is provided.
- **IF notch filter.**
  100-kHz IF notch circuit gives deep, sharp, notch, better than -40 dB.
- **Audio filter built-in.**
  Tuneable, peak-type audio filter for CW.
- **AC power supply built-in.**
  120, 220, or 240 VAC, switch selected (operates on AC only).
- **Fluorescent tube digital display.**
  Fluorescent tube digital display has analog type sub-scale with 20-kHz steps. Separate 2 digit display indicates RIT frequency shift.
- **RF speech processor.**
  RF clipper type processor provides higher average "talk-power," plus improved intelligibility. Separate "IN" and "OUT" front panel level controls.
- **One year warranty.**
  The TS-930S carries a one year limited warranty on parts and labor.

Other features:

- SSB monitor circuit, 3 step RF attenuator, VOX, and 100-kHz marker.

Optional accessories:

- AT-930 automatic antenna tuner.
- SP-930 external speaker with selectable audio filters.
- YG-455C-1 (500 Hz) or YG-455CN-1 (250 Hz) plug-in CW filters for 455-kHz IF.
- YK-88C-1 (500 Hz) CW plug-in filter for 8.83-MHz IF.
- YK-88A-1 (6 kHz) AM plug-in filter for 8.83-MHz IF.
- MC-60 (S-8) deluxe desk microphone with UP/DOWN switch.
- TL-922A linear amplifier.
- SM-220 station monitor.
- HC-10 digital world clock.
- HS-6, HS-5, HS-4 headphones.

More information on the TS-930S is available from all authorized dealers of Trio-Kenwood Communications
1111 West Walnut Street,
Compton, California 90220

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Specifications and prices are subject to change without notice or obligation.